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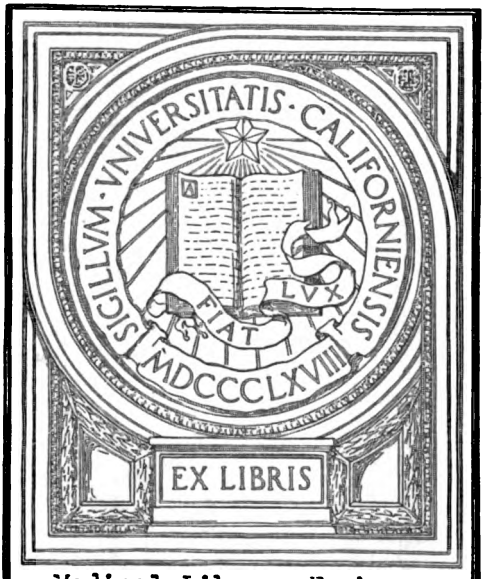

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TRANSACTIONS OF THE

SECTION ON

Obstetrics, Gynecology *and* Abdominal Surgery

UNIV. OF CALIF. MEDICAL SCHOOL

of the
American Medical Association
at the Sixty-Fifth Annual
Session, held at Atlantic City,
N. J., June 23 to 26, 1914

AMERICAN MEDICAL ASSOCIATION PRESS
CHICAGO: NINETEEN HUNDRED AND FOURTEEN

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LIST OF OFFICERS

The officers named below have served this Section. That division of practice included under the title of "Obstetrics and Gynecology" was formerly included with branches which now comprise separate sections. The names have been taken from the published records, which are deficient in some cases. It will be appreciated if any additional data are brought to the attention of the Secretary of the American Medical Association.

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PROCEEDINGS OF THE SECTION

Tuesday, June 23—Afternoon

The meeting was called to order by the Chairman, Dr. E. Gustav Zinke, Cincinnati.

Dr. Zinke then read the Chairman's address entitled "A Few Important but Unsolved Problems in Obstetrics, Gynecology and Abdominal Surgery."

Dr. Edward J. Ill, Newark, read a paper on "The Treatment of the Albuminuria of Pregnancy."

Dr. A. J. Rongy, New York, read a paper on "The Treatment of the Toxemias of Pregnancy."

These two papers were discussed by Drs. Asa B. Davis, New York; Philip Marvel, Atlantic City, N. J.; M. Howard Fussell, Philadelphia; Charles S. Bacon, Chicago; Joseph B. DeLee, Chicago; Charles L. Bonifield, Cincinnati; Edward J. Ill, Newark, and A. J. Rongy, New York.

Dr. Edward P. Davis, Philadelphia, read a paper on "The Treatment of Placenta Praevia."

Dr. John B. Deaver, Philadelphia, read a paper on "Hysterotomy."

These two papers were discussed by Drs. Richard C. Norris, Philadelphia; George M. Boyd, Philadelphia; Damon B. Pfeiffer, Philadelphia; John O. Polak, Brooklyn; John M. Fisher, Philadelphia; A. J. Rongy, New York; Joseph B. DeLee, Chicago; Swithin Chandler, Philadelphia; E. P. Davis, Philadelphia, and John B. Deaver, Philadelphia.

Wednesday, June 24—Morning

Dr. Henry O. Marcy, Boston, read a paper on "Vesicovaginal and Rectovaginal Fistulas." Discussed by Drs. J. Wesley Bovée, Washington, D. C., and Henry O. Marcy, Boston.

Dr. Thomas S. Cullen, Baltimore, read a paper on "The Embryology of the Umbilical Region" (lantern demonstration). Discussed by Drs. Henry O. Marcy, Boston, and Thomas S. Cullen, Baltimore.

The following papers were read as a Symposium on Surgery of the Large Intestine:

Dr. Arthur E. Hertzler, Kansas City, Mo.: "The Pathogenesis of the Pericolic Membranes." (Lantern demonstration.)

Dr. Joseph Rilus Eastman, Indianapolis: "Experimental and Clinical Studies of Colon Stasis." (Lantern demonstration.)

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Dr. Charles L. Bonifield, Cincinnati: "The Condition of a Few Patients Two Years After Ileosigmoidostomy."

Dr. W. J. Mayo, Rochester, Minn.: "Resection of the First Portion of the Large Intestine and the Resulting Effect on Its Function." (The paper was read by Dr. Charles H. Mayo.)

Dr. Charles A. L. Reed, Cincinnati: "Some Surgical Phases of the Sigmoid." (Lantern demonstration.)

These five papers were discussed by Drs. M. L. Harris, Chicago; Joseph Sailer, Philadelphia; John H. Gibbon, Philadelphia; John B. Deaver, Philadelphia; H. Pantzer, Indianapolis; Rosalie S. Morton, New York; J. W. Long, Greensboro, N. C.; Frank C. Yeoman, New York; Robert T. Morris, New York; Thomas S. Cullen, Baltimore; J. M. Lynch, New York; Henry O. Marcy, Boston; Joseph Rilus Eastman, Indianapolis; Charles L. Bonifield, Cincinnati; Charles H. Mayo, Rochester, and Charles A. L. Reed, Cincinnati.

Wednesday, June 24—Afternoon

A joint meeting was held with the Section on Pathology and Physiology and Pharmacology and Therapeutics.

The following papers were read in a Symposium on Specific and Protective Ferments:

Prof. Emil Abderhalden, Halle, Germany: "The Present Status of the Investigation." (In the absence of the author the paper was read by Prof. A. J. Carlson, Chicago.)

Dr. Victor Vaughan, Ann Arbor: "Parenteral Protein Digestion."

Dr. Chester M. Echols, Milwaukee: "Limitations of the Dialysis Method as a Practical Test for Pregnancy."

Dr. Henry Schwarz, St. Louis: "The Value of Abderhalden's Biologic Reaction to the Obstetrician and Gynecologist."

These four papers were discussed by Drs. Herman J. Boldt, New York; Charles S. Bacon, Chicago; Philip Williams, Philadelphia; F. H. Falls, Chicago; Charles Goodman, New York; Michael G. Wohl, Philadelphia; Clarence F. Ball, Rutland, Vt.; O. Lowry, Newark, N. J.; A. J. Carlson, Chicago, and Henry Schwarz, St. Louis.

Thursday, June 25—Morning

The following officers were nominated and elected: Chairman, Dr. Thomas S. Cullen, Baltimore; Vice-Chairman, Dr. George B. Somers, San Francisco; Secretary, Dr. Brooke M. Anspach, Philadelphia; Delegate, Dr. Channing W. Barrett, Chicago; Alternate Delegate, Dr. Henry Schwarz, St. Louis.

The Committee on Nomenclature of Operations reported that it had received a large number of suggestions which were being modified, and asked the active interest of the Section

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in its work. Discussed by Drs. H. J. Boldt and R. L. Dickinson.

Dr. Floyd E. Keene read a paper by himself and Dr. Henry K. Pancoast, Philadelphia, on "The Present Status of Pyelography." (Lantern demonstration.) Discussed by Drs. W. F. Braasch, Rochester, Minn.; Henry Dawson Furniss, New York; D. L. Eisendrath, Chicago; Arthur E. Hertzler, Kansas City; John G. Clark, Philadelphia, and Henry K. Pancoast, Bala, Pa.

Dr. Willard Bartlett, St. Louis, read a paper on "Personal Experience With Exclusion of the Pylorus in the Treatment of Ulcer." Discussed by Drs. William L. Rodman, Philadelphia; W. D. Haggard, Nashville, W. J. Jones, Chicago, and Willard Bartlett, St. Louis.

Dr. C. E. Ruth, Des Moines, Iowa, read a paper on "Common Errors in Gall-Tract Surgery." Discussed by Drs. Frederick Cotton, Boston; Edward Martin, Philadelphia; Philander Harris, Paterson, N. J.; D. N. Eisendrath, Chicago; J. H. Carstens, Detroit; John A. McGlinn, Philadelphia; F. B. Gray, Jersey City; Channing W. Barrett, Chicago; C. E. Ruth, Des Moines, Iowa.

Dr. Angus McLean, Detroit, read a paper on "Thrombosis and Emboli: Their Significance and Consequences in Abdominal Pelvic Surgery." No discussion.

Dr. Robert L. Dickinson, Brooklyn, read a paper on "Standardization of Surgery; the Attack on the Problem." No discussion.

Dr. William Edgar Darnall, Atlantic City, read a paper on "Pelvic Varicosities: A Definite Symptom-Complex." Discussed by Drs. Laura Branson, Iowa City, Iowa; J. H. Carstens, Detroit; S. M. Miller, Peoria, Ill.; Hugo Pantzer, Indianapolis; Swithin Chandler, Philadelphia; E. Gustav Zinke, Cincinnati, and William Edgar Darnall, Atlantic City.

Thursday, June 25—Afternoon

The following papers were read as a Symposium on Uterine Hemorrhage:

Dr. Emil Novak, Baltimore: "The Pathologic Physiology of Uterine Bleeding."

Dr. John G. Clark, Philadelphia: "Physiologic and Pathologic Variations of the Generative Organs Causing Atypical Bleeding; Diagnostic Aspects."

Dr. Howard A. Kelly, Baltimore: "Radium Treatment of Uterine Hemorrhage."

Dr. George E. Pfahler, Philadelphia: "Roentgen Therapy in Uterine Hemorrhage."

These four papers were discussed by Drs. C. C. Norris, Philadelphia; John A. McGlinn, Philadelphia; W. S. New-

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comet, Philadelphia; Stephen E. Tracy, Philadelphia; Curtis Burnham, Baltimore; George Erety Shoemaker, Philadelphia; George C. Johnston, Pittsburgh; Emil Novak, Baltimore; John M. Fisher, Philadelphia; Howard A. Kelly, Baltimore, and George E. Pfahler, Philadelphia.

Dr. Albert Goldspohn, Chicago, read a paper on "Fundamental Intrapelvic Perineorrhaphy."

Dr. Frederick C. Holden, New York, read a paper on "Potent Factors in Failure of Operations for Retrodisplacement of the Uterus."

These two papers were discussed by Drs. George R. White, Savannah, Ga.; H. Grad, New York; John M. Fisher, Philadelphia; C. M. Echols, Milwaukee; John A. McGlinn, Philadelphia; Channing W. Barrett; Chicago; Brooke M. Anspach, Philadelphia; Albert Goldspohn, Chicago, and Frederick C. Holden, New York.

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A FEW POINTS OF PRACTICAL IMPORTANCE IN OBSTETRICS, GYNECOLOGY AND ABDOMINAL SURGERY*

E. GUSTAV ZINKE, M. D.
CINCINNATI

Members of Section, Ladies and Gentlemen: It is needless to state that to be considered worthy of being your Chairman is keenly and gratefully appreciated. The honor came to me unsolicited, indeed, unexpectedly. I thank you most sincerely for the courtesy.

The prodigious advancement made in medicine and surgery during the past forty years, has made it impossible for one mind to master every department pertaining to the study and practice of our profession. To be as nearly perfect in one department, and to know as much of each of the other branches as time, talent and circumstances will permit, is all the ablest of us can do.

In this Section our attention is limited to obstetrics, gynecology and abdominal surgery. It takes a capable man to be master of one of these branches, but a far more able man to be master of all three. It is the object of your chairman to dwell briefly on a few important points in each, namely, intestinal stasis, painless operations, Roentgen-ray therapy in gynecology and abdominal surgery, the curative effect of radium, the Percy treatment of inoperable carcinoma uteri, the compromise operations of obstetrics, the treatment of placenta praevia, and surgery in the treatment of puerperal eclampsia.

INTESTINAL STASIS

This is unquestionably one of the most important subjects before the medical profession to-day and it is, to a large extent, for the abdominal surgeon to

* Chairman's Address.

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solve most of the details of this comparatively new phase of an old problem, and to corroborate, as far as possible, the epoch-making work and teachings of Sir Arbuthnot Lane. In his address, delivered at the North-East London Post-Graduate College, Nov. 1, 1913, Lane[1] says:

"By chronic intestinal stasis I mean that the passage of the contents of the intestinal canal is delayed sufficiently long to results in the production, in the small intestine especially, of an excess of toxic material, and in the absorption into the circulation of a greater quantity of poisonous products than the organs which convert and excrete them are able to deal with.

In consequence there exist in the circulation materials which produce degenerative changes in every single tissue of the body of which lower its resisting power to invasion by deleterious organisms.

Perhaps the best scientific confirmatory evidence I can put forward of the harmful effect of defective drainage, both of the body as a whole and of the several tissues which contribute to it, has been afforded recently by the remarkable experiments of Carrel in the growth of living tissue, in which he has shown that tissues are immortal, and grow to the greatest advantage if the drainage of their toxic products is carried out effectually.

Owing to unsuitable diet in infancy and to the habitual assumption of the erect position, delay of fecal material takes place in the large bowel, or cesspool, of the gastro-intestinal tract, or, as it can be best described, the "general drainage system of the body." In consequence of this, new membranes or resistances to downward displacement are formed by the crystallization of lines of force upon the surface of the peritoneum along which strain is especially exerted.

Thus he explains the formation of the "bands," "kinks," "folds," "veils" and "membranes" to which his own name and that of Jackson, Treves, Reid and of Jonnesco and Juvara, have been attached. It is the formation of these new structures which explains the occurrence of stricture of the bowels, of appendicitis, of disease of the ovaries, of cancer of the cecum and of the rectum. It further serves to solve the mystery of elongation and dilatation of the duodenum, the spasmodic contraction of the pylorus, the consequent

1. Lane, Sir W. Arbuthnot: On Chronic Intestinal Stasis, Brit. Med. Jour., Nov. 1, 1913.

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dilatation of the stomach from accumulation of its contents, and the "cardiospasm" of Plummer.

More than this. The changes mentioned above may terminate in ulceration and perforation about the pylorus and lesser curvature of the stomach and even cancer of this organ may result. Or changes may produce infection of the liver and gall-bladder, or lead to the formation of gall-stones, cholecystitis or malignant degeneration.

Other symptoms enumerated by Lane are: the loss of fat; wasting of muscles; degenerative changes in the skin with alteration of its texture and color; the temperature, in uncomplicated cases, is subnormal; stasis always exists in Raynaud's disease; there is mental apathy, stupidity or misery and, occasionally, melancholia or even imbecility and suicidal tendency. Neuralgia and neuritis are frequent; epileptiform tic and headaches are often present; want of control of temper which may lead to misery or even crime. Patients complain of rheumatoid aches and pains in muscles and joints; the thyroid gland wastes; the blood-pressure may be raised or depressed; the breasts show degenerative changes and cancer readily develops in them. Organs prolapse and change in size, shape and weight. The patient becomes short of breath on exertion, resembling asthma; but this may be due to distention of stomach or intestines interfering with the action of the heart. Most of the degenerative changes affecting the heart appear to be due to auto-intoxication. The kidneys may become affected. The hair of the head loses color early and falls out; hair grows in places in which it is ordinarily inconspicuous or absent. The pancreas becomes infected from stasis of the duodenum, resulting in chronic induration, inflammation and finally cancer of this organ. Pancreatic diabetes may ensue. Degenerative diseases of the eye are produced and vary with the degree of auto-intoxication.

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According to Lane, the direct changes resulting from the lowered resisting power of the tissues, produced by auto-intoxication, are: infection of the gum, causing pyorrhea alveolaris; tuberculous infection, not produced by direct inoculation; rheumatoid arthritis, which cannot develop except in the presence of defective drainage of the gastro-intestinal tract; infection, directly or indirectly, of the genito-urinary tract, through the blood-stream (by organisms other than tubercle) producing nephritis, cystitis, pyelitis, endometritis, salpingitis, etc.; development of adenomatous tumors in the thyroid gland, or general enlargement of this organ, or of exophthalmic goiter; Still's disease; infections of the skin of a pustular nature; infections of the large intestine by organisms which produce the several varieties of mucous and ulcerative colitis; and ulcerative endocarditis.

Lane states that he has "chosen merely a few obvious, typical, indirect results of the auto-intoxication of chronic intestinal stasis" and that "the point of practical interest . . . is that the drainage scheme be made to work efficiently . . . by mechanical means or by operative interference, and that the resisting power of the tissues of the body is such that they can destroy the organisms or poisons, if not advanced too far or if cancer has not developed;" and, "nothing is more remarkable in the whole range of surgery than the result of the removal of the large bowel in a case of rheumatoid arthritis. The transition is abrupt and startling."

The treatment varies: The non-operative treatment consists in the use of paraffin oil before each meal, the application of a spring support to the abdomen below the umbilicus to keep up the "transverse colon, cecum and other prolapsed viscera," and "to put into the stomach as little food as is likely to decompose and become poisonous in its passage through the intestines."

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Operative treatment is resorted to only when the above or other modes of treatment fail and may necessitate the removal of the appendix when it interferes with the lumen of the ileum; or to "short-circuit" the bowel, by dividing the ileum and putting it into the pelvic colon. If the colon is freely movable and pendulous, Lane always removes it down to its junction with the signmoid; his rule is: *Remove the large bowel, if it may be easily effected, if not, be satisfied with ileocolostomy. Gastro-enterostomy for duodenal distention, even if there is ulceration, is, in Lane's opinion, both unnecessary and harmful. If the ulceration has caused considerable reduction of the lumen of the pylorus, he resorts to gastro-enterostomy. Lane also performs gastro-enterostomy in ulceration of the stomach (in the absence of cancer) in addition to short-circuiting, with or without colectomy. He thus removes the strain from the lesser curve, effectually draining the stomach.*

Those who have carefully studied Lane's work on intestinal stasis, and the case reports of him and his followers, cannot help but be profoundly impressed by the reports of the results obtained from the operations of gastro-enterostomy, ileocolostomy or colectomy, or of all three, whether in the same subject at the same time or at different times. The profession is by no means unanimous in its opinion as to the real necessity of these heroic operative procedures for the relief of chronic intestinal stasis. Deeper delving and further investigations on part of the internist and the abdominal surgeon alone will solve the problem.

PAINLESS OPERATIONS

Crile's kinetic theory of shock and its prevention through anoci-association[2] has found favor with many surgeons. There are, however, not a few who are averse to Crile's new method. The objections most

2. Crile, George W.: The Kinetic Theory of Shock and Its Prevention through Anoci-Association (Shockless Operation), Cleveland Med. Jour., 1913, xii, 513.

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writers offer are, that the time lost in making the injections of novocain and quinin-urea-hydrochlorid is considerable, that the abdominal walls remain more or less rigid, and that the numerous and extensive injections of both drugs, necessary to anesthetize the field of operation, have a tendency to devitalize the structures involved and thus cause delay in union of the parts as well as create a predisposition to the formation of stitch-hole abscesses. Many admit, however, that "anoci-association" is an ideal and practical method. The most serious operations may be performed without the slightest pain and with total absence of shock, while the clinical results, which Crile and his associates have obtained, leave naught to be desired. In 1908 their mortality was a fraction over 4 per cent.; in the last 1,000 operations (not selected cases) the mortality was reduced to 0.8 per cent. These figures speak for themselves and are deserving of serious consideration.

ROENTGEN-RAY THERAPY IN GYNECOLOGY AND ABDOMINAL SURGERY

Many of our surgeons look on roentgenotherapy as the sovereign remedy in uncomplicated cases of uterine hemorrhages. Since, however, in the opinon of some writers, the cure is obtained solely through the destruction of the ovarian follicles, they caution against the use of the Roentgen rays in young and nervous women. Others maintain that in young women the amenorrhea which follows the application of the Roentgen rays, is only transitory; that a permanent sterilization is almost impossible; that in women near the menopause active follicles are rarely present, and destruction of the ovaries is only a precursor to the climacteric period. The appellation, "Roentgen castration," is therefore, a misnomer and incomparable to surgical castration.

The experience of Bumm, Krönig,[3] Gaus, Döderlein, Kelly, Burnam, and others with the effects of

3. Krönig, B.: Die Strahlentherapie in d. Gynäkologie, Strahlentherap., 1913, v, No. 2.

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Roentgen rays on fibroid tumors of the uterus show that uterine hemorrhage may be successfully arrested; that, frequently, the tumors diminish in size; occasionally, even a cure may be effected, though not infrequently, the tumors remain as large as before. All agree that a timely myomectomy or hysterectomy yields the most satisfactory result. The administration of the Roentgen rays is limited to those cases in which extirpation of the tumor, or of the uterus, is inadvisable and relief from hemorrhage or other symptoms alone is sought.

THE CURATIVE EFFECT OF RADIUM

The curative effect of radium on malignant disease has been vigorously assailed. Judging from the good results obtained from radium, mesothorium and the Roentgen rays, in the hands of such men as Krönig, Gaus, Döderlein, Dominici, Kelly, Burnam, Park, Parker Syms,[4] and the Ransohoffs, as well as my observations in my own cases and those of others, the scathing adverse criticism of recent date seems uncalled-for and wholly unjustifiable. Some of the favorable results obtained, especially those from radium and mesothorium, are definite and unmistakable; and while it is, perhaps, too soon to speak of the good achieved with these remedies in terms positive and absolute, it is neither fair nor just to condemn them unqualifiedly.

For the present we know that in all operative cases the knife is the best agent for combating malignant disease; and that radium, mesothorium, as well as the Roentgen ray, have proved of unexpected value in some of the inoperable cases, as well as in some of the superficial forms of cancer. Therefore, it behooves us to encourage the work of those who have occupied themselves with determining the value of these remedies in the treatment of malignant disease.

4. Syms, Parker: The Prevention and Cure of Cancer, New York State Med. Jour., May, 1913.

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THE PERCY TREATMENT OF INOPERABLE CARCINOMA UTERI

I feel it obligatory to speak a word in favor of this treatment of inoperable carcinoma uteri. Since witnessing the work of Percy in Chicago last fall, I have had an opportunity of seeing two cases of inoperable cancer of the uterus.

In one, Mrs. X, aged 48, coming into my care Nov. 15, 1913, the actual cautery (Percy method without opening the abdominal cavity) was used five different times at intervals of one week, two weeks and four weeks. At the end of that time only a small portion of the body of the uterus remained, and the vagina with the region formerly occupied by the cervix and lower uterine segment, appeared perfectly healthy, but an offensive watery vaginal discharge continued. The patient then received, at intervals of one week, three applications of radium (80 mg.) by Dr. Louis Ransohoff. The result was most marked and highly satisfactory. What there was left of indurated tissue in the vaginal vault, tenderness of the parts and of offensive discharge, disappeared promptly; the patient gained rapidly in weight, and is to-day, so far as the eye can see and the finger can feel, in every respect a healthy woman. Within the last seven weeks she has gained 20 pounds.

The other, Mrs. Y., aged 35, was first seen about the middle of March. This, too, was an inoperable case of carcinoma uteri. Up to this time the Percy method (not opening the abdomen) has been employed three times with, apparently, the same satisfactory results as in the first case. She is now ready for the radium treatment.

THE COMPROMISE OPERATIONS OF OBSTETRICS: THE INDUCTION OF PREMATURE LABOR, THE USE OF THE HIGH-FORCEPS, VERSION AND EMBRYOTOMY ON THE LIVING CHILD

In considering the so-called compromise operations, my sole object is to awaken an interest in the new therapy of narrow and contracted pelvis which, after

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the doctrine of narrow pelvis had been formulated by Litzmann and Michaelis of Kiel, has been so beautifully worked out by German obstetricians. Briefly stated, this new treatment consists of the test of labor, hebosteotomy, symphyseotomy, or abdominal cesarean section.

The hope has been expressed that the induction of premature labor, the application of the high forceps to a floating head above the pelvic brim, version, or embryotomy on a living child, might be, eventually, eliminated from obstetric practice. This hope has been realized only to a limited extent.

The induction of premature labor is to-day as popular in England as ever and is more favored in some parts of Germany. The high forceps continues, more or less, in favor in France and in this country, and version still enjoys well-deserved popularity. Aseptic midwifery and a more intelligent care of the premature infant have considerably reduced the maternal as well as fetal mortality of artificial labor. Asepsis in the use of high forceps or version has also been of value, though the maternal and fetal mortality has not, thereby, been markedly reduced.

The application of forceps to a freely floating head above the pelvic inlet, or to a head which will not engage, but steadily remains above the brim, is, with the knowledge of to-day, no longer considered good practice. A judicious perseverance in the use of high forceps in cases in which the os is fully dilated, the membranes ruptured and the head fixed at the inlet, is justifiable; but great care must be exercised to avoid injury to the child's head and damage to the soft parts of the mother. Prolonged and violent traction on the head, and the repeated introduction of the forceps by the same attendant or by different operators, cannot be too severely condemned.

Embryotomy on a living child can be regarded as justifiable only in cases of excessive hydrocephalus, extensive spina bifida, double monsters or when the fetal head is impacted in the pelvis and the child's

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life already seriously endangered, or when there is risk of rupture of the uterus, as in a case of impacted shoulder with excessive attenuation of the lower uterine segment and marked retraction of the contracted fundus. In most of these cases, version is impossible without rupture of the uterus.

Version is justifiable only in those instances in which the head is fixed on the brim of the pelvis, the mother's soft parts are uninjured, the uterus not overdistended, and a reasonable trial of the forceps have failed to deliver. (Early external, or combined version on the head or feet, as in transverse or oblique presentations, is not included here.)

The new therapy of narrow pelvis means: Send your patient to a hospital before labor begins, and give her the benefit of the test-of-labor; if this fails, perform hebosteotomy or, if need be, cesarean section. Under this management 80 per cent. of more than 30,000 patients with narrow pelvis have delivered themselves spontaneously; 15 per cent. have required hebosteotomy, and in only 5 per cent. was a cesarean section necessary. In all the maternal mortality was 0.1 per cent., and the fetal mortality about 4 per cent.

THE TREATMENT OF PLACENTA PRAEVIA

This is still an open question. Those who advocate abdominal cesarean section in every case of placenta praevia are as mistaken as those who will not admit that hysterotomy is ever necessary in this condition. The great majority of cases of placenta praevia, it is true, may be favorably treated by the use of the tampon, the rubber dilator, version or slow extraction of the child, so far as the mother is concerned. Not so with the child; the majority, or at least a very large percentage, of the children perish under this treatment. In my opinion abdominal hysterotomy is indicated in every case of placenta praevia in which the hemorrhage cannot be controlled, no matter what the condition of the cervix, the character of the child's presentation or the location of placental implantation. Thus,

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if the placenta has developed normally, the hemorrhage from a placenta praevia centralis may be readily controlled if the os is dilatable, and the presentation vertex or breech; but hemorrhage may be difficult or impossible of control in a case of placenta praevia lateralis, marginalis or partialis, if the placenta is abnormally developed (for instance when the chorionic villi have penetrated the muscularis) and when, in connection with this condition, the cervix is elongated or the os very rigid, and the presentation of the child such that a correctly placed tampon or the insertion of a rubber balloon will neither control the loss of blood, nor cause obliteration of the cervix or dilatation of the os. Of those obstetricians who put so much stress on the importance of the life of the child when advocating cesarean section for eclampsia, yet strenuously argue against cesarean section in the treatment of certain forms of placenta praevia, permit me to ask: Is not the life of the child to be considered as much, and even more, in cases of placenta praevia than in eclampsia? The child delivered through the abdomen in a case of placenta praevia has a far better chance for life than one born in the same manner in eclampsia.

THE MERITS OF SURGERY IN THE MANAGEMENT OF PUERPERAL ECLAMPSIA

In a recently published paper on eclampsia, read in New York,[5] we read the following: "The practitioner who seeks to learn from medical literature how the toxemias of pregnancy are best treated, may well feel that he has authority for the most radical treatment on the one hand and for shameful neglect of the patient's interest on the other."

In April, 1913, two papers on the treatment of eclampsia were read before the New York State Medical Society. One advocated vaginal cesarean section as one of the methods of emptying the uterus in the treatment of this disease, and the other maintained that the medical care of puerperal convulsions has

5. Bull. New York Lying-In Hosp., January, 1914.

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given the best results, so far as the mother is concerned.

The writer of the more recently published article refers to these two papers as follows:

> Any one reading those two papers on eclampsia would be in serious doubt as to how to treat a case of toxemia, because he is told on the one hand that the only real hope for the eclamptic patient lies in the immediate emptying of the uterus, *although a number will die in spite of this treatment, and on* the other hand he is assured that the only safe method of treatment of eclampsia is by purely medical means, *though a certain number of patients, approximately the same, will be lost by following this method.*[6]

The author of the paper of recent date, just referred to, does not quote a single sentence from either paper to which he alludes. This we may readily pardon; but when, carelessly or wilfully, misrepresentation is added to seemingly specious argument, it must be corrected. Personally, I welcome and always respectfully consider the severest criticism, and, as this subject is of the greatest importance to child-bearing women, I regard it as my solemn duty to make the correction on this most auspicious occasion.

The author in question states that *"approximately the same number of patients die" when treated by "purely medical means" as when subjected to "the immediate emptying of the uterus."* In my paper, to which this writer unquestionably refers, conclusive proof is furnished that, under strictly medical treatment, the collective maternal mortality is really less than 13 per cent., and that the most favorable statistics of the maternal mortality of eclampsia, when surgical means have been employed, do not fall below 28 per cent. No effort is made to prove my statements incorrect; and yet this writer has the temerity to state in the same paper that *"the published results of a large number of cases"* (of eclampsia) *"in which the abdominal cesarean section has been performed, show that the maternal mortality runs somewhere between 40 and 50 per cent."*[6]

6. Italics my own.

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My own paper[7] on eclampsia, read at Rochester before the New York State Medical Society, in 1913, is an earnest protest against the immediate emptying of the uterus after the first convulsion, or the indiscriminate performance of cesarean section, to the exclusion of every other means, for the relief of puerperal toxemia. The arguments brought forth in my paper have not been refuted, and I reiterate: *Up to the present time, we have no better means of combating puerperal eclampsia than by the hypodermic use of large doses of veratrum viride, free saline catharsis, hot baths or packs, strict milk diet and, if the patient be in labor, to facilitate its progress with or without the aid of the forceps or version on the feet.* Seeing is believing. Try this treatment and you will be convinced! Let us seek triumph only in truth!

Peterson's[8] last paper on abdominal cesarean section for eclampsia, appeared in the last issue of the *American Journal of Obstetrics.* Like all of his literary efforts, this paper again reveals his enormous capacity for work, and that he has plenty of time in which to do it. In this paper he furnishes the statistical evidence that the maternal mortality of puerperal eclampsia may be reduced to a little less than 13 per cent. when abdominal cesarean section is performed early; in other words, the maternal mortality of this disease can be made as low with abdominal hysterotomy as when treated by purely medical means.

For the sake of argument, and for the sake of argument only, this statement is accepted. It alone is sufficient to demonstrate that Peterson has, virtually, solved the problem in favor of the medical treatment of eclampsia. Who will now advocate abdominal cesarean section in every case of puerperal convulsions, if the same—and even better results—can be obtained with medical care?

4 West Seventh Street.

7. Zinke, E. Gustav: A Critical Review of the Medical and Surgcal Treatment of Puerperal Eclampsia, Am. Jour. Obstet., 1913, lxvii, No. 6.

8. Peterson, Reuben: A Critical Review of 500 Published and Unpublished Cases of Abdominal Cesarean Section for Eclampsia, Am. Jour. of Obst., June, 1914.

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THE TREATMENT OF ALBUMINURIA IN PREGNANCY

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A perusal of the literature on albuminuria of pregnancy, during the past forty years, shows that our profession was constantly on the alert to grasp anything new that would offer a chance for improvement. The interest in the treatment never flagged and at the present time we are divided into two great forces, one for active interference and the other for an expectant plan coupled with sedative and eliminative medications.

It is interesting to notice how many are constantly leaving one camp to enter the other.

During 1875 and 1876 I was a student at the obstetric department in the Vienna General Hospital, and carried away wth me the experience and teaching of Carl Braun, Bandle, Spaeth and others. The treatment was eminently conservative. Many deaths of mother and child, as I look at it to-day, have been the result. A less conservative treatment usually killed the child and many mothers were made invalids for the rest of their days by forcible delivery, unless they died of such efforts. I learned to dread this difficulty as I did no other. Every case soon became a study by itself. Every method of treatment had its pitfalls. No method of treatment sufficed for all cases. It became necessary to classify the cases as they came to me. I propose therefore to give the result of such treatment as has been my custom at the bedside.

Fads and fancies have never been indulged in. Such fanciful treatment as extirpation of both breasts

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found no favor with me. As long as our knowledge of the causation is so meager our treatment must remain empirical and the personal equation of the attendant will be a factor in the result.

While laboratory methods of diagnosis are all-important and must not be lost sight of, the clinical picture and bedside symptoms must ever be our guide for action.

The albuminuric patients who come to us early in their pregnancy and are discovered early are those whose cases rarely give us much trouble. On the other hand, the explosive cases are much to be feared. The former readily respond to diet, hot packs and purgations, especially when the subjective symptoms are mild, the percentage of urea normal, or nearly so, the quantity of albumin little, the skin active and blood-pressure not excessive.

The latter needs heroic measures. During many years of active clinical obstetric practice, I have gradually formulated for myself a classification of the cases as to their severity and treatment. In doing so, one can well separate the cases occurring in the primipara from those of the multipara for reasons to spoken of later.

In discussing albuminuria of the primipara, there are three cardinal conditions which we must consider: (1) the character of albuminuria, (2) the presence or absence of uremic symptoms, and (3) the time to which pregnancy has advanced. From these conditions it has been my custom to consider each case as coming under the following subdivision in regard to treatment. It has been my special effort at all times to do the best I can for the child. It has certain rights which should be respected.

1. A primipara who presents albuminuria of slight or moderate degree with few or no kidney elements and no uremic symptoms at a time before the viability of the child should have close observation, and a salt-free and restricted diet, with an occasional calomel

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purge. This is all that is necessary and will usually carry the case along nicely.

2. In a primipara before the viability of the child with much albuminuria and many kidney elements, reduced quantity of urea and urine but still no uremic symptoms, we are confronted with a more severe problem, for uremic symptoms with high blood-pressure may supervene at any time. I consider albuminuria of this type before the seventh month in the primipara a very serious condition. At six months and before, I have seen it but once.

Again, calomel purges, with a more restricted diet of milk and green vegetables, rest in bed, and close and constant observation is my refuge for fear the patient may lapse into the next condition.

3. We now come to the condition in which, the child being now viable, there is an increasing and severe albuminuria and many uremic symptoms, as shown by partial blindness, headache, convulsions or even coma. Fortunately the condition at this time is rare, but then also very dangerous.

If convulsions have not set in, and absolute rest, calomel, lavage of stomach and rectum, morphin-chloral, an absolute milk diet and veratrum viride have had no effect in staying the severe symptoms, we should induce labor. In these cases venesection should not be lost sight of. Time is an important element, and if we have missed our chance at an early induction of labor, convulsions and coma may supervene and we shall be driven to a vaginal or cesarean section.

The time has now come when we must empty the uterus and do it with as little injury to the mother as possible.

4. When during the viability of the child there has been a gradual, though increasing, severity of the symptoms, we should still make efforts to stave off the evil hour by such appropriate treatment as has already

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been spoken of. If, however, the reverse is the case, that is, the albuminuria and uremic symptoms have come on suddenly and with great severity, early delivery by induced labor should be our choice, provided there is sufficient time.

When convulsions have supervened or there is great edema of the retina and headache, the classical cesarean section has been my choice. I have not seen much of the vaginal cesarean section in these cases and it has seemed to me that this is rapidly losing ground with the profession.

5. Until now I have spoken of those cases that have been under careful and constant observation and I now wish to consider the patient as brought to us in convulsions, any time during the last two or three months of gestation and without any symptoms of labor.

If there are lucid intermissions and the patient talks and acts sensibly, I again make efforts to carry her along by the use of calomel and enemas; but if there is much edema by the starvation treatment, veratrum viride or morphin, etc.

When, however, there are no lucid intervals and coma is deep and lasting in spite of blood-letting, it has been my rule to proceed to a cesarean section, because I think that it offers the mother and child the best chances for life and is the least mutilating of all procedures for the former.

A forcible delivery by the vagina subjects her to no end of severe and incurable injuries and usually kills the child. Neither do I think well, therefore, of rapid dilatation, accouchement forcé, or even a turning with the cervix long, narrow and unyielding. Forcible dilatation, no matter how accomplished, with us means injury to the cervix, broad ligament, vagina and to the pelvic floor, and is commonly irreparable.

6. Lastly we arrive at that more fortunate condition when the patient in labor is brought to us in convulsions or even coma with a free dilatation or even a

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retraction of the cervix. Chloral hydrate, morphin, venesection or veratrum viride followed by the forceps give both mother and child a good chance.

I have had no experience with pituitary extract in these cases. When, however, such a primipara comes to me in convulsions without any dilatation, and not in labor, I have (with much hesitancy at first), since 1900, done cesarean section. My hesitation has lost us many children, about 60 per cent. In the latter half of my experience I have lost but 30 per cent.

Gradually I have had increased confidence, and all expectant treatment in these cases has been abandoned for that method of delivery.

In our treatment of all these cases we must not forget the dangers of chloral, morphin or veratrum viride. The latter is an especially dangerous drug and needs careful supervision.

The greater danger is with the primipara. The multipara rarely presents such violent and dangerous symptoms, but 8 per cent. of my severe fulminating cases were multiparas, and all mothers and children were saved. Albuminuria usually occurs late in the pregnancy, and convulsions and labor often seem concomitant. Those cases which show albuminuria coming on gradually are more easily managed, and I have never seen any untoward results.

During the last fourteen years we[1] have gradually abandoned all temporizing treatment in the cases of severe convulsions and have done the classical cesarean section, and record the death of 10 per cent. of mothers in forty cases, while we lost 45 per cent. of all the children.

Some of these children lived for from six hours to twelve days, but were recorded as lost because they were still in the hospital. During the time that we temporized, say the first twenty cases, we lost 60 per cent. of the children while the mothers' death-rate was 10 per cent.

1. The cases reported are those of Dr. Charles L. Ill and myself and our assistants.

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If we had refused operations in the cases that have been subjected to vaginal interference, the death-rate of the mothers would have been but 5 per cent. None of these patients were in labor; they were all antepartum cases. When we look back to the days of forcible dilatations and delivery, and remember all the invalid mothers, we are glad to record the freedom from the pelvic injuries. Many patients report repeated pregnancies following our work, one as many as seven, with perfect freedom from accidents.

By the kindness of Dr. Bunting of Elizabeth, N. J., I have his report of twenty-nine cases of convulsions carefully tabulated and skilfully treated after the manner of the Rotunda Hospital. He records 17.2 per cent. of deaths of the mothers, and 37.9 per cent. of deaths of the child. Of the latter, 14 per cent. were thought not to have been viable. All the mothers were brought in with convulsions and about 10 per cent. were multiparas with no loss of the mothers and one dead child, one child alive and one child not yet born, the mother having recovered from the illness; 79.3 per cent. of the cases were delivered naturally and about 7 per cent. were forceps cases and a similar number of cases had induced labor.

I am glad to have these figures, as they represent an excellent result of the expectative plan of treatment as practiced by the Rotunda Hospital, of which morphin, repeated as convulsions return, lavage of the stomach and colon, castor oil and croton oil, absolute quietness and starvation are the main features.

This treatment is worthy of our consideration and offers the non-operating obstetricians a good field for observation and satisfactory results. To compare results in various hands I have looked over a few statistics published in 1912. I find that Helsingfors has a mortality of 30.8 per cent. for mothers in the cases of forcible delivery. Nothing is said of the miserable condition of the mothers who have recovered in after-life. Voight of Berlin reports 43.7 per cent.

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of deaths of the mothers delivered by the Stroganoff method and 37.5 per cent. of the children.

The Geneva clinic represents a death-rate from conservative therapy of 52.2 per cent. for the mothers and 61 per cent. for the children. In rapid delivery the mothers' death-rate is 10 per cent. and the child's 12.5 per cent.

Bellingham-Smith reports a death-rate of the mother after conservative treatment of 16 per cent.

Dührssen has 15 per cent. of deaths following active treatment. Our results for the mother and child compare well with these and we shall continue until convinced of something better.

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TREATMENT OF THE TOXEMIAS OF PREGNANCY

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In recent years our conception of the toxemias associated with pregnancy has assumed an entirely new aspect. We are now beginning to realize that all the symptoms incident to gestation are secondary to some substances circulating in the maternal blood-stream, which have their origin in the products of conception; that is, from the fetus or placenta, or perhaps from the rapidly growing uterus. The severity of the symptoms depends on the quantity of these substances thrown into circulation, and also on the ability of the mother to react to these substances.

Heretofore all our investigations were directed to the changes found in the kidney, liver and even the brain, and the symptom-complex was attributed to the alteration of function in these organs. The pathologic changes found in the various organs, in patients who succumbed to one of the toxemias of pregnancy, are at present considered secondary to the effects produced by the foreign substances circulating in the maternal blood-stream.

The nature and exact origin of these substances is as yet not definitely known. The preponderance of clinical investigation, however, points to the fact that these symptoms of intoxication are due to a protein substance found in the blood-stream of the pregnant woman and never present in the non-pregnant state.

CAUSATION OF TOXEMIAS OF PREGNANCY

The studies and observations of Abderhalden prove conclusively that there is a definite reaction in the serum taken from the pregnant woman and that the

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blood undergoes great changes. The recent studies of Rubsamen and Schwartz and others prove that the serum taken from cases of the various forms of toxemias has a markedly deficient, or an entire absence of, cleaving power. Investigations as to the cause of the onset of labor, recently published by von der Heide, Weltz and myself, I believe, furnish additional proof that the various conditions associated with the toxemias of pregnancy have their origin in the maternal circulation. Heide considers his results in reference to the onset of labor as an anaphylactic reaction. He thinks that normally the birth act is brought about by the slow transmission of fetal substances into the blood of the mother which gives rise to the formation of antibodies — "labor substances," as he terms them. Toward the end of gestation these substances are transmitted to the blood of the mother in excessive amounts. That there is a deluge of these substances is proved by the contractions which arise in the last weeks of pregnancy and also by the uniform results obtained by the injection of fetal serum in inertia.

The whole range of the toxemias of pregnancy, and especially eclampsia, should be viewed from the point of view of the maternal circulation overcharged with foreign protein substances. In eclampsia, we have many clinical manifestations pointing to this. The sudden onset of symptoms and their sudden disappearance, the sudden changes found in the urine and their sudden disappearance, the more frequent occurrence of toxemias in primiparas and the fact that eclampsia is more frequent in twin pregnancies tend to prove that these manifestations have their origin in the fetus and placenta.

Wolff-Eisner has proved positively that during pregnancy foreign protein substances are continually thrown into the circulation of the mother and that these substances under certain conditions bring about

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a state of eclampsia. He contends that eclampsia must be considered as the rarest and most severe form of those symptoms dependent on the absorption of foreign albuminoids. The single manifestation of the absorption of foreign substances during pregnancy stands in the same relation clinically as the varied reactions due to the absorption of the pollen protein, harmless conjunctivitis on the one hand, and severe asthmatic attacks on the other, both caused by the absorption of the same pollen protein.

I believe that the references cited above and the observations of many others will ultimately establish the fact that the toxemias of pregnancy are invariably due to a disturbed metabolism, or to be more exact, a loss of metabolic equilibrium in the mother, produced by some foreign substance originating in the fetus or placenta. Normally, these foreign substances are neutralized by the formation of antibodies and therefore no harmful effects result in the greatest number of cases. If, however, the mother is unable to produce a sufficient amount of antibodies or, on the other hand, if the production of foreign substances is disproportionately great, the equilibrium of the maternal metabolism is disturbed, resulting in one of the forms of toxemia.

TREATMENT

Having formulated a probable underlying etiologic factor for the toxemias of pregnancy, we shall now turn our attention to their treatment. Clinically, we recognize two definite varieties of intoxications: (*a*) those occurring in the early months of pregnancy characterized by nausea, morning-sickness, which in a good number of cases if not properly attended to terminates in the severe intoxication commonly known as the pernicious vomiting of pregnancy, and (*b*) those occurring in the last three months of pregnancy, characterized by headache, dimness of vision, slight epigastric pain, an appreciable rise in the blood-

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pressure and appearance of albumin in the urine. Practically all these cases, unless promptly attended to, terminate in eclampsia, with all its accompanying pathologic complications.

Our success in the treatment of these conditions must depend primarily on the ability to recognize the premonitory signs and symptoms which are always present as a danger-signal. We have succeeded in educating the profession at large to the fact that there is a definite preeclamptic stage, and therefore in carefully observed cases, eclampsia is usually prevented. Unfortunately the same cannot be said to be true of toxemias occurring in the early months. This is so, for in the majority of cases we do not give serious thought or consideration to the patient until symptoms of pernicious vomiting have set in, and it is then often too late for treatment. We must now come to realize that as there is a definite preeclamptic state, so is there also a premonitory stage to pernicious vomiting, which should be easily recognized. Given a case of persistent vomiting and retching, bearing no relation to the intake of food, with an appreciable increase in the pulse-rate, and beginning signs of emaciation, the case, if not attended to and allowed to continue, will terminate fatally.

In the light of experience, I dare say that prophylaxis is the key-note to the successful treatment of all forms of the toxemias of pregnancy, and that no case which is carefully observed should be permitted to reach a stage of pernicious vomiting or eclampsia. Our attitude in these cases must be, and unalterably so, that if the patient does not promptly respond to treatment, pregnancy must be quickly terminated. No one, no matter what his experience may be, can undertake to foretell how rapidly the patient's condition may reach a point which will defy any and all of our known therapeutic measures. Our duty, therefore, is to conserve the life of the mother primarily, and no treatment is justifiable which tends to save the child at the expense of the mother.

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Experience has taught us that toxemias of pregnancy usually do not recur. On the contrary, we have come to believe that once a patient has passed through one of the forms of intoxication associated with pregnancy, she has probably become immunized against future recurrences. Formerly pregnancy was forbidden to a patient who had had eclampsia, while now we do not consider it an obstacle to future pregnancies.

In the course of my investigations with fetal serum to cause the onset of labor my attention was first directed to the possibility that the toxemias are caused by some foreign protein substances circulating in the maternal stream which have their origin in the product of conception. Case 19 of that series was that of a woman who was admitted to the hospital with severe symptoms of threatening eclampsia. She had severe headache, disturbance of vision, slight edema of the lower extremities with a history of having passed very little urine during the past twenty-four hours. Examination of urine showed it to be full of albumin and casts. In view of the clinical findings, induction of labor was decided on. The patient was a relative of one of the nurses on the hospital staff. The various methods of induction of labor, including the use of fetal serum, were suggested. She was asked if she had any objection to the use of the serum. Her answer was "to use my own discretion in the case."

I decided to bring on labor by the use of the serum, and not only did it cause the onset of labor, but also the urinary symptoms cleared up after the first injection, all toxic symptoms improving before labor actually set in. Realizing the possible therapeutic value of placental serum in late toxemia of pregnancy, I decided to make use of it in early toxemia, that of pernicious vomiting.

How does the serum act? If it is true that foreign substances which are of toxic nature are constantly thrown into the circulation of the pregnant woman, we are naturally justified in assuming that all women who pass through pregnancy and labor normally must

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of necessity produce certain neutralizing elements which counteract these toxic substances. Therefore the injection of serum from a normal healthy pregnant woman into one who for some reason is unable to produce these antibodies will not only actually add these neutralizing substances, but also stimulate the circulation toward an increased formation of them.

In order thoroughly to study and arrive at a definite conclusion of the effects produced by the injection of serum in the various toxemias of pregnancy, it is necessary to begin treatment early, before the maternal system is saturated with these toxic substances. In early cases the therapeutic effect of serum should be almost spontaneous. Unfortunately we have not the opportunity of seeing the patient until the condition is far advanced, all remedial measures having already been tried without avail. The patient is then brought to the hospital usually emaciated, with high pulse-rate and all the signs and symptoms of exhaustion. In the latter period of pregnancy, the patient has either had convulsions or is threatened with one. At this stage no amount of serum can possibly be of any value, for not only will the quantity required to counteract this advanced intoxicated condition be too great, but the time lost by this treatment added to the uncertainty of the outcome compels us to resort to a safer method, namely, the prompt interruption of pregnancy.

The advantage of the serum treatment is that if improvement is to take place, it is usually noticed very early, and if after a trial of from thirty-six to forty-eight hours the patient fails to show signs of improvement, it should be discontinued. My experience with the use of placental serum consists of four cases of pernicious vomiting and three cases of threatened eclampsia.

Case 1.—History No. 3808. Mrs. J. G., aged 28; primipara, Russian, wife of dentist, patient of Dr. P. Hurowitz, menstruated last, Sept. 10, 1912. She gives history of persistent vomiting for the past five weeks; was confined to bed the last four weeks. She lost a good deal of weight, and seemed

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exhausted. Interruption of pregnancy was advised by attending physician. I saw her at her home with Dr. Hurowitz, November 21. We decided to remove her to the hospital and try the injection of fetal serum, and if no signs of improvement were noticed within from thirty-six to forty-eight hours, to induce an abortion.

She was admitted to the Jewish Maternity Hospital the same day. Urine showed slight traces of albumin; urea normal; specific gravity, 1.012; some granular casts. Blood-pressure was 95. Ten c.c. of placental serum was injected intramuscularly at 5:50 p. m. Patient continued to vomit. At 8 p. m., 10 c.c. of placental serum was again injected. Patient felt somewhat nauseated but did not vomit. She slept from 12:30 to 5:50 a. m. and did not vomit during the night.

November 22, 10 a. m., 10 c.c. of placental serum were injected into the right thigh. Patient did not vomit during the day but felt highly nauseated; passed 35 ounces of urine during the twenty-four hours.

November 23, patient did not vomit but complained of pain in the back and abdomen and of a slight headache.

November 24 and 25, patient felt very much improved.

November 26, general diet was given. She continued to improve and was discharged from the hospital November 28.

Patient remained well until December 7, when she again commenced to vomit. I was not notified until December 10, when I saw her again. She appeared quite exhausted. She was readmitted to the hospital on the same day. At 4 p. m. 10 c.c. of placental serum was injected and a second injection of 10 c.c. was given at 8 p. m. Patient did not vomit until 11 p. m.

December 11, 2 p. m., 15 c.c. were injected. Blood-pressure 110. Patient felt very much nauseated but did not vomit. At 8 p. m. she began to vomit quite severely. Ten c.c. were again injected.

December 12, 1 a. m., patient vomited fluid tinged with blood, but did not vomit any more during the night.

December 13, patient vomited once, but felt nauseated the entire day. December 14, patient complained of pain in the abdomen; vomited once at 9 p. m. and felt nauseated.

December 15, 10 c.c. of serum again injected. Patient did not vomit. General condition better. December 16, patient vomited twice, felt weak. December 17, she vomited a few times but did not seem to be affected by it; felt much better.

December 18, patient vomited a few times and felt nauseated. At this stage of her illness her general condition was very much better. While she still vomited a few times she retained a good deal of food. I commenced to give her 2 drams of the placental serum by mouth, every two hours.

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Patient still vomited occasionally until December 22, when her vomiting ceased.

She remained in the hospital until December 31, and was discharged in good condition.

CASE 2.—History No. 3946. S. B., aged 20, primpara, pregnant eight weeks, was confined at Mount Vernon Hospital in charge of Dr. Goodwin. General condition was very poor. It was doubtful if she could withstand interruption of pregnancy. Her pulse remained between 140 and 150. I suggested to Dr. Goodwin to try placental serum as there was not much to lose. Patient was transferred to the Jewish Maternity Hospital the same morning, Dec. 30, 1912. At 3 p. m. 12 c.c. of placental serum were injected intramuscularly. Patient still continued to vomit. Two drams of serum every two hours were given by mouth.

December 31, patient continued to vomit, but general condition was better, conjunctivae less jaundiced.

January 1, pulse dropped to 108 and patient was vomiting less; she retained a certain amount of a koumiss preparation.

January 2, general condition was much better; pulse between 108 and 116; patient complained of some headache.

January 3, patient was put on general diet and during the following ten days of her stay in the hospital she gradually improved, vomiting only occasionally. She was discharged, January 13, in good condition.

CASE 3.—History No. 4023. A. G., patient of Dr. Ralph Waldo, admitted to Lebanon Hospital, Feb. 24, 1913. Tertipara. Three weeks prior to her admission she began to vomit and at the same time to lose weight. Urinary examination showed traces of albumin, 7½ grains of urea to the ounce and a few hyaline and granular casts. Notwithstanding all treatment, patient continued to vomit. March 7, at the suggestion of the pathologist, Dr. E. Bernstein, 15 c.c. of placental serum were injected intramuscularly. Patient vomited half an ounce of greenish fluid. An hour later she began to retain some broth and soup. March 9, 10 c.c. of serum were again injected. Patient was taking more nourishment. March 11, patient developed erysipelas of the right ear and face. March 13, patient died while expelling the fetus.

CASE 4.—Patient of Dr. Dorsey M. Lewis of Middletown, Del., aged 38, sextipara, menstruated last Oct. 6, 1911; admitted to the Jewish Maternity Hospital, May 12, 1912, with the following history: Three weeks prior to her admission, patient commenced to have severe headaches and general weakness; felt nauseated and vomited two or three times a day. At the same time she noticed that her sight was failing. On admission patient gave all the classical symptoms of an impending eclampsia. Induction of labor was decided

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on and at the same time 10 c.c. of placental serum was given intramuscularly.

May 13, patient had a comfortable night, headache slightly better. Blood-pressure fell from 238 to 180.

May 14, catheter was removed as it failed to produce uterine contractions. Patient was again injected with 26 c.c. of placental serum. Her general condition was much better; passed a greater quantity of urine and eyesight improved. Blood-pressure 165.

May 15, general condition good; patient felt comfortable. Blood-pressure 190. Five c.c. of serum again injected.

May 16, patient much brighter, was able to write address on an envelope. Five c.c. of serum given.

May 17, patient began to complain of slight abdominal pain. At 9 p. m. active labor pains set in and patient was delivered at 11 p. m., child weighing 4 pounds 11 ounces, and alive. Patient gradually improved and was discharged May 29. In this patient I am not certain what caused labor to set in as the catheter was removed three days prior to the onset of labor. It is questionable whether the continued use of placental serum did not incite uterine contractions. The general improvement noticed after the first injection of the serum, however, no longer made me feel concerned as to the termination of labor.

Case 5.—D. M., aged 30, secundipara, menstruated last June 15, 1911. Admitted to the hospital March 4, 1913, complaining of severe headaches, dimness of vision and slight edema of the legs. Urine was full of albumin, and hyaline and granular casts. March 5, at 2 p. m., patient was injected with 11 c.c. of placental serum, intravenously. After the first injection she appeared improved, the albumin and casts diminished in quantity, she developed a polyuria, and in three days all the symptoms pointing to eclampsia disappeared. March 6, patient was again injected with 22 c.c. of placental serum. March 7, another injection of 20 c.c. was given. She was delivered March 7, at 3 p. m., of a female child weighing 8 pounds. In this patient the serum was used to cause the onset of labor, as mentioned above.

Case 6.—A. S., aged 28, primipara, had two miscarriages, first in the fifth week, second at two months. Menstruated last Dec. 1, 1912. About two weeks later, patient began to complain of some distress over the lower portion of the sternum. Same continued until about January 15, when she began to vomit, increasing in severity and not limited to any period of the day.

She was admitted to the Jewish Maternity Hospital March 17. Fifteen c.c. of placental serum were given intramuscularly with no appreciable effect. Two drams of the serum was given every two hours by mouth. March 18, 10 c.c. of serum were injected; patient still vomited, but general

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appearance was better. Blood-pressure 120. March 19, 20, 21 and 22, patient's condition was better; she retained some food. March 23 and 24, patient felt much worse, did not retain any food, very restless and had severe headache. Blood-pressure 111. Patient felt slightly better on the 25th, 26th and 27th. March 28, patient grew worse and I decided to inject the serum intravenously. Ten c.c. were given. Patient had slight reaction and some precardial pain lasting about five minutes. The following day the patient did not vomit. March 30, patient once vomited during the night. March 31, patient began to vomit again, but not so severely. Partly retained food. Urine analysis showed no albumin or casts.

The diet for these patients was not limited. The nurse was instructed to give them all the food they asked for. As a general principle they were given lesser quantities at more frequent intervals. Vomiting was not a contra-indication for food. The patients' preference for a particular variety of food was always attended to. They were all given large quantities of water to drink. As a rule, they were kept in bed, and as soon as the general condition improved they sat up on a chair and even walked about the room. These patients as a rule do not sleep and are restless, and this was controlled by trional in sufficient doses. Sleep is essential in these cases of exhaustion.

ECLAMPSIA AND ITS TREATMENT

The great advance of surgery in recent years, and the safety with which the entrance into the peritoneal cavity has been made, very naturally have opened a new field for the relief of this condition, and the treatment of eclampsia soon became a battle-field for those who held opposing views.

The maternal and fetal mortality has always been so great that the obstetrician was very eager to avail himself of procedures, radical in nature, but surgically apparently correct, and based on sound reasoning. This brought forth two distinct groups of men: (*a*) those who advocated the immediate emptying of the uterus, either by vaginal or abdominal cesarean section, and (*b*) those who adopted a watchful waiting

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policy, and treated the convulsions, instead of striking at the root by interrupting pregnancy.

At this juncture, I wish to state that while statistics are mathematically correct, still the point of view of the author is usually injected into them, and of necessity they may be in a measure so influenced that their intrinsic value is partly lost. We cannot and should not treat our patients dogmatically. No two cases in medicine act alike. To adopt a general rule and apply it universally eliminates one's personal experience and judgment. Particularly is this true in eclampsia. In our experience we seldom found two cases which acted exactly alike and in which precisely the same form of treatment could be instituted. Therefore to maintain that every case of eclampsia must be treated by a radical surgical operation is just as wrong as to assume that eclampsia must be let alone and treated medically.

How then are we to proceed in the treatment of this condition? Are we to adopt one or the other of the two methods, or are we to individualize our patients and institute treatment accordingly?

I believe that eclampsia is produced by some toxic substance circulating in the maternal blood, the origin of which is most probably in the products of conception. In order to cure the patient we must remove the cause, and, therefore, pregnancy should be terminated. By the interruption of pregnancy, we in a great majority of cases tend to help accomplish what Nature has already begun to do. It is well known that in a great number of cases of eclampsia, Nature tries to relieve herself of the intoxication by causing labor to set in. In the management of all obstetric conditions there is one underlying principle, namely, that our treatment should as far as possible imitate the natural processes which take place during labor, and any radical departure from the normal will tend to endanger the life of the patient.

Close observation by the experienced obstetrician will disclose the important fact that the fatality of

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eclampsia depends on the degree of toxicity and not on the presence or number of convulsions. We have seen patients die after a single convulsion, and on the other hand, we have seen recovery take place after twenty and more convulsions.

The cardinal signs and symptoms by which we may judge the degree of toxicity clinically are the quantity of urine excreted, ascertained by catheterization (absence of, small quantity of, or highly bloody urine always points to a grave prognosis); absence of lucid intervals between convulsions, and high pulse-rate. The presence of one or more of these signs bespeaks a grave prognosis. On the other hand, if the quantity of urine excreted is not greatly diminished, with a pulse-rate under 120 and with a more or less clear mental state between convulsions, the prognosis is correspondingly more favorable.

From the foregoing it may be seen that clinically eclampsia may be of varying degrees, and the mode of treatment instituted always depends on the degree of intoxication which we are called on to combat.

During the past six years, in the services of the Jewish Maternity and Lebanon hospitals, I have had the opportunity of observing ninety cases; sixteen patients died, and of this number three died intra partum, shortly after they were brought to the hospital, before treatment could be instituted, thus leaving thirteen cases as a post-delivery mortality, or 15.5 per cent.

When it is realized that the greatest proportion of these were emergency ambulance cases, in charge of midwives or the family physicians, all patients having had a number of convulsions previous to admission to the hospital, I think that the percentage mortality is not unduly high.

In this series of cases all recognized forms of treatment were carried out. The method usually adopted depended on the period of gestation and the rapidity with which delivery had to be terminated, as evidenced by the clinical signs and symptoms. In cases

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in which labor had already set in, delivery was usually completed by manual dilatation, or by dilating-bags, followed by forceps or breech extraction. Patients in whom the toxemia was apparently mild, having absolutely lucid intervals between convulsions and in whom the pulse-rate was not affected to any degree, were treated by catheter or dilating-bags, in order to have labor set in. Patients in whom eclampsia occurred before the seventh month, with severe toxemia, were delivered by Dührssen incisions. I believe that in this class of cases, high incision of the cervix is the ideal method for delivery.

Delivery by vaginal cesarean section was adopted in all eclamptic patients not in labor, with long and rigid os during the seventh and early part of the eighth months of gestation.

Abdominal cesarean section was performed during the last four or five weeks of pregnancy in primiparas having the severe toxemia, not in labor, with long and rigid cervix. In this class of cases abdominal section has a definitely useful field. While it may add a slight additional risk to the mother, the margin of safety for the child is so great that, to my mind, it justifies this procedure. Vaginal cesarean section in these cases should never be the operation of choice, for the operator may encounter many obstacles which will complicate the operation and which at the same time endanger the life of the child. These patients, in order to have the best show for recovery, must be delivered in a minimum time and with the least possible trauma. This is not readily accomplished by adopting the vaginal route.

The routine medicinal treatment used for controlling the convulsions consisted in large doses of fluidextract of veratrum viride, associated with small doses of nitroglycerin. Morphin in large doses was used in patients who were restless between attacks. If the convulsive seizure was severe and seemed to exhaust the patient, ether was administered. In my experience, no one of these drugs seemed to exert any specific action.

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Venesection and drawing off from 10 to 16 ounces of blood was resorted to in plethoric patients with high blood-pressure. This procedure tends to relieve the congestion of the viscera and at the same time withdraws a certain amount of toxins from the system.

CONCLUSIONS

The purpose of this paper is primarily to point out the very important fact that the toxemias of pregnancy cannot always be treated by either the radical or the conservative methods, and that the clinical varieties of eclampsia are such that no one method is applicable to all.

While I believe that the uterus should be emptied in all cases of eclampsia, still each case must be individualized in order that the proper procedure may be adopted. Finally, I believe that if an active campaign of education would be instituted among the physicians as well as the public, and attention called to the fact that there is present a definite preeclamptic stage and that there are premonitory symptoms in pernicious vomiting of pregnancy, the mortality and morbidity of the various toxemias of pregnancy could be greatly reduced or even entirely eliminated.

62 West Eighty-Ninth Street.

ABSTRACT OF DISCUSSION

ON PAPERS OF DRS. ILL AND RONGY

DR. ASA B. DAVIS, New York: That which we should strive for is, first, to prevent eclampsia, to avoid the necessity of radical medical or surgical procedures. I believe that our progress in saving these mothers and children will be by close, watchful care of the pregnant women from early pregnancy until after the puerperium is safely over. And to that end I think we all need to recognize, as we are more rapidly recognizing, that the pregnant state is not a simple one, and that at any moment it may become most serious and threatening. For that reason the pregnant woman should receive more careful consideration than is the general custom to-day. We can do much to prevent these severe toxemias by the careful regulation of the patient's life; also, when the complications do arise, by treating them while they are yet simple.

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Often, in primiparas, we see transitory albuminuria which, left in that state, amounts to very little; but when casts appear, hyaline and granular, we usually have with that condition an excess of indican, an increase of acidosis, poor elimination. If the patients were treated at this time as we treat them when in a more dangerous condition, we would soon tide them over this threatening period and they would be restored to comparative safety. We can do much by elimination, rest, diet, protection from exposure to cold and from undue nervous strain at such times. Relative to the difference between the toxemias of early pregnancy and those of later pregnancy, we find that in the so-called pernicious vomiting, some patients can be controlled and carried along until these symptoms subside. In other cases, treatment, except emptying the uterus, seems to have no effect on the condition. We have noticed that emptying the uterus in these early cases is not resorted to as readily as in cases in the later stage of pregnancy when convulsions have or have not occurred. It is, therefore, not safe to allow these cases to go to the extreme time, as we do in the later months of pregnancy. The tendency is to be more conservative in the treatment of these toxemias of pregnancy and labor. There are encouraging reports of resort to this conservative method; but I believe that, in the face of active symptoms—an active clinical picture—we must, as has been said, consider each case individually and treat it accordingly, whether that is elimination by every channel of waste. In many cases we are forced to such a process if we are to save our patient.

Dr. Philip Marvel, Atlantic City: Two points which have not been brought out are: the importance of observing the hypertension in these cases, and the use of pilocarpin. I think those of you who have followed these cases from their incipiency will agree with me that hypertension is one of the most important persistent symptoms which gives some definite knowledge of the fact that there is in a particular case some pathologic condition growing, so to speak. I believe, as the last speaker stated, that in these cases the pathologic condition is secondary. I also think that eclampsia is undoubtedly one of primary toxemia, whether it be due to the foreign protein matter that is circulating in the maternal blood—as Dr. Rongy has mentioned—or whether it be due to other foreign substances, we are not yet, so far as I know, in a position to give its definite cause; but, be that as it may, I think most of us who have seen a number of these cases, have observed a continuous rising hypertension. Various ways have been suggested for reducing hypertension in other conditions, not all of which are advantageous in eclampsia. I am prepared to say that in two cases I have used a remedy which is worthy of consideration. It is pilocarpin. In the two cases in which I have used pilocarpin, I did so in the dose of

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1/50 of a grain three times a day with fair quantities of water, and in both cases it was noticeable that the hypertension began to fall in twenty-four hours. Elimination was very much increased, and the patients both did well. I know not whether this was a mere coincidence, or whether the drug may have had some strong therapeutic influence. In the medical treatment of this condition I think it is well worth our further trial, and I recommend that its possible advantage be kept in mind.

Dr. M. H. Fussell, Philadelphia: The key-note of the family doctor's procedure in labor cases, as well as in his general work, must be the education of his patients and eternal vigilance in his diagnosis and treatment of them. He must tell his obstetric patient that she must be under his care continually from the time of conception until she is properly dismissed in the puerperium. The care the woman needs, and in which she must be instructed, is to prevent, to recognize, and to cure her toxemia at the onset. The diet of a pregnant woman should be ample in food value, but easily assimilated, and not irritating to the kidneys and the liver, consisting of carbohydrates, fresh vegetables, meat once a day in such proportions as will freely nourish the patient but will not irritate the kidneys and the liver, which need to be fully active in order to take care of the metabolic products dependent on pregnancy, and on which toxemia depends. Exercise should be regulated to be neither so excessive that the woman will be exhausted, nor so slight that there will be a retention of by-products of digestion which will irritate and perhaps make inefficient both the kidneys and liver—for on the efficiency of these two great eliminators depends the freedom from toxic symptoms. Therefore, continuous, routine examination of the urine is absolutely necessary in every pregnant woman. The examination must be made every two weeks at the beginning, and every week later on, in normal cases. If any sign of insufficient action of the kidneys, such as albumin or casts occurs, then a daily examination must invariably be made. Albumin not of renal origin is a common occurrence in the urine of pregnant women; hence when albumin appears a microscopic examination must always be made. The use of the phenolsulphonephthalein test is of great importance. High blood-pressure in pregnant women is of the most serious import, whether or not there is albumin in the urine. The pressure should be taken regularly every two weeks, and later every week. A gradual rise must lead to treatment. The symptoms indicative of toxemia are: headache, indigestion, pain in the epigastrium, edema of the legs, disturbances of vision, drowsiness, unconsciousness and convulsive seizures. When suggestive symptoms occur and when blood-pressure begins to rise, when albumin appears in the urine, the patient must at once be put to bed, diet reduced to milk, and the

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patient sweated and purged and in severe cases bled from the arm. With care in the use of these potent remedies, many cases will become non-toxic, then the patient can be allowed out of bed, the diet can be gradually increased, and the patient allowed to go about her duties, but such cases need constant watching.

DR. CHARLES S. BACON, Chicago: Every care must be taken of the patient as soon as she shows any sign of toxemia. Many believe in interrupting pregnancy early in cases of pernicious vomiting. That is often an excuse for the interruption of pregnancy and has led to some harm. I have, until quite recently, been opposed to this position. I was influenced first by the great experience of Shauta, who found that it was possible to carry the cases through without interruption of the pregnancy. I have persisted very often in the very serious cases, but recently the results in a number of cases have made me very doubtful about the wisdom of that course. I have found that the toxemia of early pregnancy is often followed by the toxemia of later pregnancy with albuminuria, and finally eclampsia has not infrequently followed the pernicious vomiting. This has led me to believe that in the very serious cases it is probably better not to try too long to carry through the pregnancy without interruption.

DR. JOSEPH B. DELEE, Chicago: Statistics have only a relative value. Whether the statistics regarding the treatment of puerperal eclampsia speak for this, that or the other treatment, makes little difference to the man who is treating the case. The man who has experience in a certain number of cases will be able to draw conclusions as to the best method of treatment regardless of statistics. I therefore feel that the individual experiences of men if they are capable of judging is worth very much more in discussion than statistics. I consider the eclampsia as yet an unknown quantity. We do not know the cause of these toxins which we believe are circulating in the blood and which upset metabolism, neither do we know the chemical nature of these toxins. When we meet a woman suffering from the effects of these toxins we know nothing, therefore, about the nature of her suffering. We do know this, however, that the ultimate cause of her toxemia is the pregnancy. If she were not pregnant she would not be toxic, and, therefore, the quickest and safest way—from that point of view, mind you—of curing this so-called toxemia is to remove the pregnancy. Is rapid delivery more dangerous than the toxemia itself? That is a matter of individual experience and practice. I, therefore, place myself on record in favor of the active treatment of eclampsia. Since we cannot remove the toxemia I believe that I am treating my patient best by removing the pregnancy which is the cause of the toxemia. One other point regarding the treatment of early toxemia of pregnancy: We are still more in the dark regard-

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ing the treatment of pernicious vomiting of pregnancy than we are the treatment of eclampsia. I do not always know when I have curetted the uterus in pernicious vomiting whether I saved the patient's life, or whether it was necessary at all. I have had several cases in which the women have had fever, actual jaundice, when I thought even that I detected a diminution of the area in the liver dulness, when there has been albumin in large amounts, blood, granular and hyaline casts in the urine, when sugar has been present and pentose discovered, when under the influence of purely nervous method of treatment—psychic, you might call it—the woman suddenly spontaneously recovered. Therefore, I feel that there is an element in these cases of early toxemia at least, which is absolutely terra incognita, and that our treatment is more and more empirical.

Dr. Charles L. Bonifield, Cincinnati: Dr. Ill said he thought he had seen a patient die from the influence of veratrum viride. He made another remark afterward with which I could not agree—that veratrum viride was a very dangerous drug. If this were true, I and a number of friends would surely have killed a large number of patients, because we use it frequently. We use it in what the text-books would call very large doses. If I believed a patient to be suffering from eclampsia and she had a high blood-tension and a pulse anything over a hundred, I should not at all hesitate to give her 30 minims of Norwood's tincture, or its equivalent hypodermatically at once, repeating the dose with 10 drops every hour until the pulse came down to 60. I have seen this done so many times with nothing but beneficent results that I cannot believe that veratrum is a very dangerous drug. One other thing I would emphasize. We hear mentioned the use of morphin and veratrum at the same time. They are physiologic antagonists. If you have a patient suffering from veratrum poisoning and become alarmed, give a hypodermatic injection of morphin and she will usually recover in a short time. In and around Cincinnati, where veratrum is largely used, I have never known of a death. Our only guide in the use of the drug is to bring the pulse down to 60. Usually if you get it below 60 the patient will not have a convulsion. The last case I saw of this kind was two weeks ago. When I arrived the family physician had given the patient 60 minims in divided doses. Under my instruction he gave her 20 more. I had the pleasure of seeing her regain consciousness while I remained in the room. I believe in operations. The indication always is to empty the uterus, because the pregnancy is causing the convulsions. We must get rid of it in the way that causes the least shock to the nervous system, because we know from experience that these patients can be thrown into convulsion by a noise or slight trauma. Therefore, some procedure that can be rapidly done under an anesthetic seems

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to me to be indicated, such as, in the early months, vaginal cesarean section; in the later months, abdominal cesarean section.

Dr. Edward J. Ill, Newark, N. J.: Concerning Dr. Marvel's suggestion of pilocarpin, we used that years ago and have discarded it. It is apt to produce dangerous symptoms, among them an excessive bronchorrhea. The cases that come to us early are not the dangerous cases. The dangerous cases are those in which you find albuminuria in large quantity to-day while yesterday there was neither albuminuria nor a high blood-pressure, or those in which convulsions occur to-day while three days ago urine and blood-pressure were perfectly normal. Those are the cases which so commonly need a cesarean section. Such cases usually follow a big dinner. My impression is that one of the causes of albuminuria might be found as a result of damaged kidneys from scarlet fever contracted during early life. It certainly has been true in a large number of cases. We are told by one of the speakers that statistics are of use only to the man who is giving them. Commonly, I should say that the man that gives us no statistics either has none or else they are so bad that he does not care to publish them. My experience has been that the pernicious vomiting in pregnancy occurs most commonly with a pernicious doctor, or with one who is too comfortable to exert himself. During thirty-nine years of active practice I have been obliged to induce abortion but twice for pernicious vomiting.

Dr. A. J. Rongy, New York: With reference to pernicious vomiting, I have seen four women die because the uterus was not emptied before they reached the fourth month, and possibly many more would have died if pregnancy had not been interrupted. I do not advocate the emptying of the uterus in the early months of pregnancy unless there are definite signs and symptoms of severe toxemia. The same treatment is suggested in late pregnancy. In patients in whom there is a persistent pulse-rate over 120, with emaciation and vomiting regardless of the intake of food, the uterus should be emptied. Even should you carry such patients through four or six months of pregnancy, they may still develop toxemia in the later stages. Simple albuminuria is of no importance, unless it is accompanied by headache and general malaise. The constitutional symptoms accompanying the albuminuria warn us of danger. One of the most important symptoms so far as the toxemia is concerned, is an appreciable increase in blood-pressure. The keynote of the matter lies in the prevention of pernicious vomiting of pregnancy and of eclampsia. We have definite premonitory signs in pernicious vomiting of pregnancy. We have definite signs in the preeclamptic state. Our duty is to educate the general practitioners to give careful attention to these patients.

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THE TREATMENT OF PLACENTA PRAEVIA

EDWARD P. DAVIS, M.D.
PHILADELPHIA

In the advance which the science of obstetrics has made in the last fifteen years, this serious condition with others of like importance, has received new consideration, and some changes have been suggested in its treatment.

At present we recognize that septic infection is quite as important in causing the death of the mother as hemorrhage or shock. It has also been repeatedly demonstrated that placenta praevia causes such a vascular condition of the cervix and lower uterine segment that forcible dilatation or vaginal cesarean section exposes the patient to great danger from hemorrhage and infection. Furthermore, so grave a complication as placenta praevia demands hospital facilities and the skill of experienced hospital operators.

My experience leads me to agree with the conclusions just stated, and I desire, in addition, to present this subject to you from the following point of view: Logically, placenta praevia is a variety of ectopic gestation. The normal location of attachment of the impregnated ovum during its greatest period of development is the wall of the upper expulsive segment of the uterus near the orifice of the fallopian tube from which it emerged. When the impregnated ovum remains in the graafian follicle, the fallopian tube or the upper wall of the uterus, its growth inevitably causes rupture and hemorrhage. The danger of septic infection, however, is primarily inconsiderable. When the impregnated ovum attaches itself below its usual

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site of development, hemorrhage is likewise inevitable because pregnancy must be terminated with dilatation of the cervix, and dilatation inevitably produces separation and bleeding. The danger of infection is equally great because pathogenic bacteria are frequently present in the vagina, and repeated examinations and manipulation must convey them to the placental site. Hence there are some conditions in favor of the patient with the upper variety of ectopic gestation as against the patient who has the low variety, or placenta praevia. From this point of view, that method of treatment will be most successful which controls hemorrhage with the minimum risk of infection.

Again, cases of placenta praevia may be, for purposes of treatment, divided into those in which hospital facilities are promptly obtained and those which are treated outside of hospital. In hospital cases, operations which the general practitioner cannot safely attempt may be undertaken with a fair chance of success. If ectopic pregnancy of the upper variety is of sufficient gravity to demand the services of a skilful operator, with hospital facilities if possible, ectopic gestation of the lower variety, or placenta praevia, is equally grave.

Let us consider first those cases which come under the care of the general practitioner of medicine and which cannot be conveyed to hospital.

Two important factors must be kept in mind under these circumstances:

1. Any vaginal hemorrhage in a pregnant woman is a symptom of danger and must not be neglected. Because hemorrhage from placenta praevia is accompanied by no pain, it is frequently neglected by patients.

2. In dealing with these cases the danger of infection must be kept prominently in view. Vaginal exam-

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inations and manipulation must be as infrequent as possible, and the use of the tampon should be avoided.

Without minute classification, placenta praevia may be divided into those cases in which the os is not entirely covered by placenta and in which the membranes can be reached, and those cases in which the membranes cannot be reached. In the hands of the general practitioner and in private houses, the best treatment in the first class of cases is to rupture the membranes as extensively as possible, when dilatation permits this maneuver. Tonic doses of strychnin are then given and the patient is allowed to deliver herself, or, at least, is made to force the presenting part down to the vulva before artificial delivery is undertaken. In this way hemorrhage and infection will be reduced to a minimum, and although the risk to the child is great the mother's safety should be first considered.

In complete placenta praevia, in the hands of the general practitioner in a private house, the Braxton-Hicks method of bringing down the leg and breech of the child as a plug should give the mother the best chance. To accomplish this, anesthesia, partial or complete, may be required. The placenta must be perforated by one or two fingers, combined version performed, and the leg seized and drawn through the placenta. Only sufficient traction should be made to bring the breech firmly into the pelvic cavity and against the cervix and placenta. Under no circumstances should forcible and immediate extraction be practiced. The life of the child should be disregarded in the interests of the mother. If a constant tension on the child is desired, a noose of bandage should be slipped about the child's ankle and a moderate weight attached. The mother may then be stimulated as required, care being taken to avoid the use of ergot and pituitary extract. Strychnin, atropin and digitalin hypodermatically, with salt solution injected into a

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vein or connective tissue, will be found especially useful. The mother demands constant observation until labor finally develops, and the fetus, if possible, is expelled spontaneously. In placenta praevia the practitioner must expect and be forewarned against post partum bleeding. The delivery of the child should be followed by the delivery of the placenta, irrigation of the uterus with a hot 1 per cent. dilution of liquor cresolis compositus or normal salt solution, and firm packing of the uterus, cervix and vagina with 10 per cent. iodoform gauze. If undue traction is avoided and spontaneous expulsion of the fetus secured, there will be no dangerous laceration of the cervix; but if undue violence has been employed the cervix may be severely torn, and severe or fatal hemorrhage may follow. Under these circumstances immediate suture of the cervix may be necessary.

In hospital practice, with the mother in good condition and the membranes available for rupture, the escape of the amniotic liquid may be followed by the introduction of a dilating bag through the rent in the membranes into the cavity of the amnion. This should be gradually distended to its fullest extent securing dilatation of the cervix with pressure on the placenta. When dilatation is sufficiently advanced the child may be delivered by forceps, in many cases advantageously, with a minimum risk to the mother and with a great reduction in fetal mortality.

When the membranes are not available for rupture, and when the cervix is resisting, because in a primipara it is poorly developed, or in a multipara has been altered by scar tissue from previous confinement, mother and child will obtain the best result by prompt resort to abdominal cesarean section. If the child is premature or dying or dead, from long-continued maternal hemorrhage, the placenta may be perforated by the fingers and combined version practiced and the

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child's body used as a plug to check maternal bleeding. Spontaneous delivery and uterine contraction must be secured in the manner already described.

If the child be living and in good condition, the cervix soft and dilatable, and the head presenting, with the patient in hospital, the obstetrician may elect to pierce the placenta and insert a dilating bag through it within the cavity of the amnion. This bag may be distended with antiseptic fluid, hemorrhage checked by pressure, and gradual dilatation of the cervix thus secured. With good dilatation the use of the forceps will sometimes secure a living child. In hospital practice, however, where the child is fully viable, mother and child will obtain the best results by abdominal cesarean section. At full term in hospital cases, whether the child be living or dead, the mother will obtain her best chance for recovery by the same method. Our experience in abdominal cesarean section for placenta praevia comprises seventeen cases. In these the membranes were not available and the placenta practically covered the entire internal os. In some of these patients the child was dead or dying and the mother exsanguinated. All were at or near term.

The method of operation consisted in opening the abdomen, turning out the uterus, incising it and immediately removing its contents. It was interesting to observe how completely hemorrhage ceased when the uterus was emptied. The uterine cavity was then thoroughly irrigated with hot sterile salt solution and packed firmly with 10 per cent. iodoform gauze carried through the cervix into the vagina. The uterus and abdomen were closed in the usual manner. The vagina was sponged out with mercuric chlorid solution and firmly tamponed with sterile or mercuric chlorid gauze. During the operation the patient received intravenous saline transfusion, and strychnin, digitalin and atropin were given hypodermatically. In exsan-

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guinated cases the patient was kept in the Trendelenburg posture until reaction occurred, and external heat, rectal injection of stimulants and oxygen inhalation were used with success.

Of the seventeen patients three were especially exsanguinated through severe and repeated hemorrhages. All the mothers recovered. The maternal mortality was nil; the fetal mortality 40 per cent. There was no maternal morbidity except slow recovery incident to severe anemia. Infection did not develop.

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HYSTEROTOMY

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Since 1912, when my paper on hysterotomy was read before this Section, I have had twenty-five cases in addition to the fourteen then reported in which I have done this operation. Thus far there has been no mortality and no complication, either immediate or remote, as far as I am able to determine. This experience has strengthened my conviction that an active surgeon engaged in pelvic work not infrequently encounters cases in which this operation is a distinct addition to his diagnostic and therapeutic resources; that its dangers and disadvantages are theoretical rather than real, and therefore that condemnation of the operation by those who have had no experience with it is but another instance of that false conservatism and adherence to tradition which has blocked the early adoption of many salutary measures.

The general indications for hysterotomy may be stated as (1) to establish a prompt and certain diagnosis when a reasonable suspicion exists of malignant disease of the interior of the uterus; (2) for the prompt termination of pregnancy in cases in which life is acutely endangered by the continuance of that condition.

Of the twenty-five operations during the past two years, fifteen were performed for indications of the first class and ten for indications of the second class. In other words, 60 per cent. of the operations were undertaken with the well-defined idea that some early neoplastic process was present in the interior of the

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uterus, and 40 per cent. because of danger to life by reason of complications of pregnancy. The following is a brief summary of the findings. In two cases a single myoma was found in a pregnant uterus. I could not determine to my own satisfaction whether or not the enlargement of the uterus was due to pregnancy or to a submucous fibroid. A hysterotomy revealed pregnancy which was then terminated. It demonstrated however, that the uterus was normal except for a single myoma, which was enucleated and the woman thus was saved from the more mutilating and dangerous operation of hysterectomy, not to mention the preservation of her sexual functions. In two cases incision of the enlarged symmetrical uterus showed a single submucous myoma, which was enucleated and the uterus after repair left *in situ*.

In one case of symmetrically enlarged uterus, incision showed multiple intramural fibroids and a hyperplastic state of the endometrium. This was sufficient indication for removal of the uterus. The microscope showed a chronic interstitial metritis in addition to the gross changes.

In six cases of irregular bleeding leading to a suspicion of malignant disease the incision showed in three degenerated products of conception, and in three partial separation of the placenta.

I am willing to debit these cases against the operation, for I would not by design open the uterus intra-abdominally for these conditions. Unfortunately, however, I cannot always tell a pregnant uterus when I have it in my hands, much less diagnose the condition by signs and symptoms in the very early months. If there is any one in the world who has this phenomenal ability let him cast the first stone.

In two cases of premature separation of the placenta there was good reason to suspect placenta praevia, which I consider an absolute indication for hysterotomy.

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One case of chorio-epithelioma in very early stage was revealed by this incision. A brief history may be of interest.

A woman 32 years of age was taken ill six months before admission with pain in the left iliac region radiating to chest and back. At intervals she has had return of this pain, which for the past two months has become much more severe. A leukorrheal discharge, frequently blood-stained, was constantly present. The hemoglobin was 70 per cent. The uterus reached 4 cm. above the pubis. At operation the uterus presented no external abnormality. By hysterotomy the products of conception were removed and a friable ulcerated area seen on the posterior wall. The uterus was removed. Microscopic examination showed chorio-epithelioma.

In one case a very early carcinoma was detected in the extreme left cornu. The patient was a woman aged 54, who had been bleeding irregularly for two years. During the past three months the flow had become much more profuse. There was no pain. Examination was negative. At operation the uterus was small and the appendages appeared normal. Hysterotomy was done. In the left cornu a friable ulcerated area was apparent. Malignancy was suspected and the uterus removed. The microscopic examination revealed an early adenocarcinoma at the suspected area.

In ten cases hysterotomy was done for the urgent necessity of terminating pregnancy. In one case of contracted pelvis with the fetus at term the classical cesarean section was employed, both mother and child being saved. Concerning this type of hysterotomy fortunately there is now no noteworthy difference of opinion. The simplicity and safety of the operation, however, are still not thoroughly appreciated, owing to the fact that there is a considerable statistical mortality. When it is realized that this mortality is almost wholly due to depletion of the patient's powers by

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unavailing attempts at delivery by other means, together with the subsequent infection that attacks a large percentage of women so mistreated, the operation will be more often performed as a primary procedure and the maternal mortality will approach the vanishing-point while many more children will be saved and disabling birth injuries avoided.

In one case of toxemia of pregnancy with eclampsia at six months delivery was effected by hysterotomy. The child was not viable, but the mother, who was only 20 years old, recovered promptly. This operation was done in February, 1913. The patient is now in the eighth month of a second pregnancy, the course of which is proceeding uneventfully without signs or symptoms of toxemia.

Hysterotomy is not advised for all cases of toxemia of pregnancy. There are few serious conditions the onset of which can be detected so readily as this. Undoubtedly palliative treatment should be instituted at the outset on the first indication of nephritis, increased blood-pressure, digestive or visual disturbances. If toxemia increases in spite of treatment it is, in my opinion, an absolute indication for the termination of pregnancy. If the condition has been detected early there is ample time for the induction of premature labor. In neglected cases, however, and particularly in the event of eclampsia, the quickest, safest and surest method of dealing with the condition is by hysterotomy. It matters not for this discussion what is the nature and cause of the toxemia, for it is clear enough that pregnancy is at bottom responsible for it. The sooner pregnancy is interrupted the more quickly does the cause cease to operate. Moreover, hysterotomy is a rapid and safe means of delivery, making but little demand on the vital powers of the patient, which can by no means be said of *accouchement forcé* or of the methods of induction of premature labor. Naturally, in the late cases there will be a mortality under any method of

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treatment, owing to irreparable damage to the essential organs, but that procedure which at once relieves the underlying condition and makes least demand on the vital powers of the patient should certainly be the method of choice.

In three cases of placenta praevia delivery was by hysterotomy. The duration of pregnancy was three, five and six months, respectively. In two cases the attachment of the placenta was marginal and in one central. In all I have performed hysterotomy in eight cases of placenta praevia without maternal mortality. The absolute command of hemorrhage which the surgeon has during the operation of hysterotomy is sharply contrasted with the danger from bleeding under the more common procedures of operative obstetrics. Shock is less and the liability to infection is certainly not greater. Under proper circumstances for laparotomy there can be little excuse for flirting with death by the uncertain methods so largely in vogue.

In five cases I emptied the uterus by hysterotomy because of a severe renal infection amounting to sepsis. Simple pyelitis is not an indication for hysterotomy. Palliative measures or local treatment will in most instances effect a cure. When, however, the general condition is alarming, this operation will give the most rapid and happy results. In one case, actuated by conservatism, I refused to empty the uterus, a decision which later I regretted, as the unfortunate woman in her debilitated condition contracted a severe puerperal infection from the effects of which she died. When a septic focus exists in the body with consequent infection of the blood-stream, there is grave danger of auto-infection of the uterus after childbirth. The circumstances of the patient must be considered among the indications for the termination of pregnancy under these conditions. When the patient is able to command good treatment and hygienic surroundings, every effort should be made to carry her

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through to term. A patient of the poorer classes, however, who has to look forward to some months of advancing pregnancy in a septic state that does not yield to such treatment as can be carried out and maintained, is entitled to have her life considered the paramount issue.

Let us now examine the net results in the twenty-five cases treated. There was no mortality. The morbidity was only that of an ordinary laparotomy. There was but one complication, a wound infection, not properly chargeable to the hysterotomy, as the uterus itself was uninfected. Only three uteri were sacrificed, one each for carcinoma, chorio-epithelioma and myoma of the uterus associated with chronic metritis and endometritis. One eclamptic patient was cured and is again normally pregnant. In one case of contracted pelvis treatment was successful for mother and child. Five patients with partial separation of the placenta were relieved and three patients with placenta praevia were snatched from imminent danger. In the remaining cases, while the operation was not life-saving, yet in its results it challenges any other form of treatment yet devised.

That the operation is not in itself dangerous is shown by the absence of mortality in this series and corroborated by the experience of Russell of Johns Hopkins, who, in 1905, reported thirty-two cases without death. Dickinson in an excellent article on diagnostic hysterotomy with a summary of twenty-seven cases expressed great satisfaction with the operation, but did not state definitely whether he had had any mortality. Howard Kelly, in a personal communication, states that he has performed hysterotomy in about sixty cases without mortality from the operation. From memory he speaks of a case similar to some of my own, which gave him particular satisfaction. This was an instance of single submucous myoma, not palpable but productive of excessive flow, pain and ill health. The patient had been condemned to a

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radical operation, but by hysterotomy and removal of the submucous myoma the size of a hickory-nut she was cured and has remained so for ten years. A considerable number of sporadic cases exist in the literature and were encountered in the preparation of this article. While no attempt at completeness was made, it was noteworthy that not a death was reported as following the operation. To Russell's opinion that "suprapubic hysterotomy is of conspicuous service in cases of persistent uterine hemorrhage which is not controlled by any form of treatment and in which bimanual palpation of the pelvic organs has given an absolutely negative diagnosis" I can give hearty assent. I believe, however, that its use may be extended with benefit, as in the cases here cited, and that the term may be advantageously employed to cover the incision of the uterus in the interest of the mother in the early months of pregnancy, the child not being viable.

Hysterotomy is destined to be of great service in the early diagnosis of cancer of the fundus of the uterus. There are many who maintain that surgery has reached its limit in the treatment of cancer of the uterus and that we must mark time until an improvement is brought about in diagnosis. In my opinion, surgery has not reached its limit until it has assisted in every possible way in the early diagnosis. I hear a great noise of many voices saying that we are now in possession of such a method in the curet and microscopic section. If I did not know the difficulties of thorough curettage, of the gathering and preparation of all the scrapings and the subsequent chance of failure to section the malignant area, I might be tempted to agree; but the mortifying experiences which I have had and which I have known the most competent and thorough men to have in attempting to scrape out the contents of a uterus, lead me to distrust the curet, which I fully believe is the most abused and over-rated instrument in the gynecologists' armamentarium. Four weeks ago a woman, aged

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24, consulted me in regard to vaginal bleeding. Six months previously she had miscarried at three months. Following this she bled and came under the care of one of the most competent gynecologists in Philadelphia. She was curetted at operation, but not enough was obtained, in the judgment of the operator, to account for the hemorrhage. The abdomen was accordingly opened. The uterus appeared normal and therefore the abdomen was closed. When she came to me she had hemorrhagic fungating masses on the anterior and posterior walls of the vagina, probably chorioepithelioma. Here the curet failed; and moreover, if it was justifiable to open the abdomen why not the uterus, the seat of the diseased condition? This simple and proved innocuous procedure might have made the difference between cure and a hopeless outlook three months later.

Vaginal incision of the anterior wall of the uterus has been advanced as a satisfactory substitute and a safer operation than suprapubic hysterotomy. Technically, it is somewhat more tedious and difficult, though that in itself would be no bar to its acceptance did it possess any real advantages. On the contrary, it fails of its object in exposing the entire fundus. The anterior wall of the uterus can be incised only as far as the peritoneal reflexion of the bladder. The field is small and difficult to keep clear of blood, and the cornua cannot be seen. In addition to this, there is a real danger of injury to the bladder and urethra, as has actually occurred. The carcinoma of the cornu here reported could not have been seen by this method. It should be understood that the hysterotomy incision is for the purpose of seeing and that palpation will not suffice for the diagnosis of early cancer of the uterus. The uterus itself is hard and its consistency is not noticeably increased by the implantation of cancer. We must depend on a ragged, friable, easily bleeding and possibly ulcerated surface, characteristics appreciable only to the eye.

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Not only can we detect a percentage of early cancers by hysterotomy, but in a more considerable percentage of cases in which cancer is reasonably believed to exist will the incision reveal the true cause of the bleeding in hyperplastic endometritis, polyps of the endometrium or small submucous myomas. These conditions may necessitate only local treatment which can be made thorough and complete under the guidance of the eye. The impossibility of thorough removal of a hyperplastic polypoid endometrium by blind scraping can be appreciated only when such a uterus is freely opened and the actual condition seen. To those who are able to delude themselves into the belief that they can accomplish the impossible, the operation of hysterotomy will not appeal.

The operation itself is simple. The abdomen is opened by the usual paramedian incision. The uterus is grasped in volsellum forceps and carefully packed off by moist gauze pads. The anterior surface is then incised down to the peritoneal reflexion of the bladder, which may be carried forward if necessary. With small retractors the interior may be completely exposed to view. If the uterus is to be allowed to remain the incision is closed by buried layers of chromicized catgut sutures extending down to, but not through, the endometrium. Accurate apposition is essential. A running seromuscular stitch of linen placed close to the edge and invaginating the serosa completes the closure.

1634 Walnut Street.

ABSTRACT OF DISCUSSION

ON PAPERS OF DRS. DAVIS AND DEAVER

DR. RICHARD C. NORRIS, Philadelphia: The important advances in recent obstetrics have been surgical, and yet, it is my conviction that surgery applied to obstetrics should come, not from the general surgeon, but from the trained surgical obstetrician. The problem is not, what surgery can do, but rather what it must do. I believe that cesarean section is an operation in the obstetrician's armamentarium that

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will be resorted to more and more frequently. The problem is not to find out how often we can do it, but how often we must do it. Hysterotomy for routine diagnosis is "going some." The curet has helped us, as also has intra-uterine exploration with the intelligent finger, and our laboratory methods combined with the clinical history. When these means of diagnosis fail us, which is very seldom, there are a few cases which bring the patient to the surgeon's knife. The abdomen is opened and what happens? Time and again you will take the uterus out after you have cut it open. Your diagnosis is pretty well made beforehand or you would not operate. There are a few cases in which we are perplexed; but, let it not go forth from this Section, that if you don't know what is wrong inside a woman's uterus, you should cut it open to find out. Such a doctrine is pernicious and all the more so when taught by a distinguished surgeon.

In the treatment of placenta praevia an analysis of statistics will show that the mortality lies with the infected patient. Preliminary care of the patient is necessary. We see cases of placenta praevia in which the patients are so exsanguinated and so surely infected that it would be an obstetrical folly, and a surgical crime, to do a cesarean section. There are cases recognized promptly, and early brought to the obstetrical surgeon, in which cesarean section is the ideal procedure—and the well-trained obstetrician recognizes that. You can reduce the mortality of placenta praevia by training the profession to treat cases early, in the proper way, far more than by advocating cesarean section for every case. It is a campaign of education of the rank and file that is the real burden of the efficient obstetrician and surgeon. The time is at hand when modern surgery applied to obstetrics will add to her laurels and increase her triumphs.

Dr. George M. Boyd, Philadelphia: Prophylaxis, I believe, is the keynote of the whole situation. On the one hand, we have numerous danger signs in the toxemia of pregnancy leading to eclampsia which if heeded will prevent this condition. This is not so markedly the case in placenta praevia. Here the patient is seemingly well and in 75 per cent. of cases she will go nearly to the end of gestation without a danger sign. She then begins to bleed and it is in the early recognition of the magnitude of this hemorrhage that safety lies. We must teach the student to look with great gravity on this hemorrhage in the last months of pregnancy. He must look on such a patient as one suffering from arterial hemorrhage and must make an accurate diagnosis. If to do this requires anesthetization and the patient refuses he had better turn the case over to some one else to treat. It is then, in the early recognition of placenta praevia that we can do effective work. The treatment of placenta praevia

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formed the subject of the opening discussion in the seventeenth meeting of the International Congress in London. As a result of that discussion I reached the conclusion that, in the majority of cases, the patient is best treated by bipolar version. The patients die of infection and also of hemorrhage. A few cases will probably be better treated by ciliohysterotomy. In 1901 I presented, as part of a symposium on placenta praevia in our county medical society, a paper on cesarean section in placenta praevia and it was pretty sharply criticised. Since that time I have followed two or three of the maternities in our city. I advocated it at that time in the restricted sense in the primipara with a central implantation of the placenta. I still feel that it has a field of usefulness although limited. In only two cases have I felt that cesarean section was indicated. In both cases the patients flatly refused operation. I believe both would have been better served by cesarean section. I would emphasize the necessity of early recognition of placenta praevia and its immediate and radical treatment. In the majority of cases in the hands of the general practitioner I believe we serve our patients best by performing bipolar version.

Dr. Damon B. Pfeiffer, Philadelphia: Any one who has had my opportunity of seeing numerous uteri removed by various able and conscientious surgeons, must have received the impression that gynecologic diagnosis lacks something in that precision which is necessary in fitting the operation to the case. We may be horrified at the prospect of incising uteri unnecessarily. Are we not horrified at the prospect of removing uteri unnecessarily? I believe that very many uteri are removed every year for conditions which would not warrant hysterectomy. This movement toward diagnostic incision is the result of a demand for better diagnosis on which to base our most radical procedures. Mistakes occur usually in connection with bleeding, a symptom which demands recognition of its cause in order to determine the treatment which is adapted to the particular underlying pathologic condition. We admit, of course, that many uteri must be removed for bleeding, the cause of which is at the present time inexplicable. It is a different matter when you remove a uterus with a small submucous myoma, a small isolated polyp or a hyperplastic endometritis. In all these cases diagnosis could have been made earlier, I think by hysterotomy than by curettage.

Dr. John Osborn Polak, Brooklyn: I do not think that we should decide against or in favor of hysterotomy without taking some of the considerations for and against. It is a pitiable condition if we cannot make a diagnosis without opening the abdomen for diagnosis. Hysterotomy has a definite place. Why any man should do hysterotomy on early placenta praevia or for diagnosis in the early months

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of pregnancy I cannot see. Day after day we do hysterotomy in questionable bleeding of the uterus by the vagina. We come to exactly the same conclusion that has been so admirably expressed here: Feel and see what is inside the uterus and the cornu, and I don't think there is any difficulty in doing it. In some 500 cases of vaginal operations that we have done I have injured the bladder just once, and I did it only last week, showing a man how easy it was to do it. Dr. Deaver's statement that abdominal hysterotomy should be used as a diagnostic method, is admirable in Dr. Deaver's hospital, in Dr. Deaver's hands, but it is a most dangerous statement to take out of this Section. Again in the early toxemias of pregnancy why should we do abdominal hysterotomy when we could empty the uterus by vaginal hysterotomy with no morbidity? There I am absolutely assured.

Dr. John M. Fisher, Philadelphia: It is not necessary to have the eye on everything within the uterus in order to make a proper diagnosis. Dr. Deaver has spoken of curetting as being almost the only method we have of determining the condition of the interior of the uterus, save that of hysterotomy. We all know that it is possible to dilute the uterus so that the finger can be introduced and that by the educated finger a diagnosis can be made of the presence of abnormal conditions within the uterine cavity. I recall a case in particular of a woman in the Philadelphia Hospital who had found her way into the surgical department of the institution, referred to us as having cancer of the body of the uterus requiring hysterectomy. Dilatation of the os and digital exploration of the uterus demonstrated retention of fetal bones. These had been there almost four years and had become imbedded in the substance of the body of the uterus. The history of an offensive discharge covering four years should have sufficiently demonstrated to the surgeons that the case was not one of cancer. For another case a piece of gauze was found introduced by a man who had curetted some months previously. In this, likewise, a diagnosis had been made of cancer of the uterus. After dilating the cavity of the uterus a proper diagnosis was readily made. I saw a case of persistent bleeding recently in which curetting had been done twice, and the woman was still bleeding. As the curetting had been done by general surgeons, not by a gynecologist, we thought that possibly something had been missed. The patient had had an abortion several months previously. By the introduction of the finger through the previously dilated cervix the cause of the bleeding was easily determined to be a small mass attached to one cornu of the uterus. The mass was removed and the bleeding ceased. So with other cases. Hysterotomy for the diagnosis of submucous fibroids is rarely necessary. Dilatation of the uterus can be effected with the finger, bougies, metra-

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noiter or lamina tents (properly sterilized), so that a satisfactory digital exploration can be made. The man who does hysterotomy for diagnosing submucous fibroids in all cases is making a serious mistake because it is absolutely unnecessary. So in many cases of cancer of the body of the uterus, early diagnosis can be frequently made by the finger. The gynecologist develops a sense of touch for determining things that the general surgeon has to see.

DR. A. J. RONGY, New York: As long as we relegate the treatment of placenta praevia to the general practitioner, so long will the standard of the practice of obstetrics be low. The success in the treatment of placenta praevia depends greatly on how early the diagnosis is made and how promptly treatment is instituted. The average practitioner must be taught that irregular bleeding in the later months of pregnancy is significant of placenta praevia and therefore should presuppose this condition to the exclusion of all others. The factors governing the mortality in placenta praevia are many. From a clinical point of view placenta praevia is a form of acute hemorrhage complicated by pregnancy and the indication is, in the greatest number of cases, to terminate both, as quickly as possible. I therefore am strongly in favor of performing cesarean section in cases of central placenta praevia, after the thirty-fifth week of gestation, in which labor has not yet set in. Vaginal cesarean section for placenta praevia should never be performed, for the hemorrhage may become profuse on account of the sinous condition of the lower uterine segment.

DR. JOSEPH B. DELEE, Chicago: I have performed cesarean section for placenta praevia eight times. At the same time and during this period I have treated sixty-eight other cases of placenta praevia myself and the mortality of the cesarean cases has been nil. The mortality in the sixty-eight other cases has been three. Of these cases two patients died of hemorrhage, one of whom I believe would have lived had I done cesarean section. At the same time the obstetrician is the one and the only one capable of saying which case is proper for cesarean section. A large majority of placenta praevia cases can be successfully treated from below without "flirting with death." It is my conviction that the placenta praevia case is the case for the specialist obstetrician. A general practitioner, with a large amount of obstetric experience cannot accumulate sufficient technical skill to handle these grave complications. The curet has certainly been damned too much because it has not been used correctly. It has deserved a great deal of this condemnation. I use the curet for diagnosis, and by a systematic going over of the anterior, posterior and lateral surfaces find we do much with properly shaped instruments and the uterus steadied in its position by the outside hand. The

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fingers within the vagina guide the curet in the uterus and the operation will give a great deal of positive and definite though not final information. Emphasis was placed on the education of the doctors regarding the first hemorrhage in pregnancy. We should educate not alone the doctors, but the public, and we can educate the public to educate the doctors. The public should demand high obstetric skill and this demand can be brought through the women's clubs. In Chicago we organized a little club, "The Mother's Aid Society," which has rapidly grown to over 700 members. Its slogan is "High Standards of Obstetric Practice," and you would marvel at the formerly neglected obstetric conditions which are now referred to the doctors. This, done by a few women, well shows what can be done by the large federated clubs of women.

Dr. Swithin Chandler, Philadelphia: I am sure Dr. Deaver doesn't mean that every time a patient with pelvic disturbances comes to him he is going to do a hysterotomy, but that he is going to use his best judgment; that when he has a case indicating a serious pelvic condition, he is just as able as any one whether a gynecologist or not, to determine that by the ordinary means. To attack this operation of Dr. Deaver's we must consider two things: Either the operation itself must be dangerous or else the use of it in making a diagnosis is unwarranted. We certainly cannot attack the operation on the ground that it is dangerous. I do not agree with the men who state that the finger can always tell the condition present, nor can this be done always with the eye. If I have a case in which there has been a curettage and in which I cannot tell the condition by the finger, history of the case, etc., I shall do Dr. Deaver's operation. The man who does not, under such conditions is, in my opinion, just as guilty as the man who neglects a case until it is too late for operation. I would depend on Dr. Deaver to use his judgment in the individual case.

Dr. Edward P. Davis, Philadelphia: What is the status of the widest experience in the world to-day concerning placenta praevia? A recent investigation in one of the principal provinces of Germany, a country under the best medical conditions, shows that of all women dying in the perils of childbirth, 10 per cent. die from placenta praevia. What are the results of the treatment of placenta praevia in private houses by men trained in the universities of Continental Europe, and who have had hospital experience? Will 820 cases give you an idea? Probably a correct one or fairly so. They give a maternal mortality of 10.9 per cent.; a fetal mortality of from 40 to 60 per cent. Now let us take our cases of placenta praevia in hospitals; in the Congress in Berlin in the summer of 1912, was given the interesting report of Couvelaire in the Tarnier clinic at Paris, of 162 placenta praevias of serious nature without cesarean section, using the

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dilating bag and the rupture of the membranes, with a maternal mortality of 6.7 per cent., fetal, from 44 to 66 per cent. If we go to the Leipsic Clinic of Zweifel, than whom there is no more able obstetrician and gynecologist to-day, we find him getting, in placenta praevia, by combined version under strict asepsis, a maternal mortality of 3.3 per cent.; a fetal mortality of 68.8 per cent.; and by using the bag as described in my paper, we find him reducing the maternal mortality to 2.6 per cent. and bringing down the fetal mortality to 26.8 per cent. This must be taken as the acme of hospital treatment by skilled men without abdominal cesarean section. In the Freiburg clinic, a series of thirty-eight cases treated by abdominal cesarean section by Pankow gave a maternal mortality of 2.5 per cent.; a fetal mortality of 2.9 per cent. the lowest rate for mother and child yet reported. The question of abdominal cesarean section depends for its solution on whether the parturient woman in her complications is deserving of the care which a woman with appendicitis or ovarian cyst receives, or whether she shall have the older and less efficient methods. I hold it a gross injustice to the general practitioner of medicine that he be asked to undertake such responsibility under disadvantages, as he has been called on to do in the past, in obstetric practice. He has borne this responsibility alone and unaided, at any hour of the day or night, and he has done things from which the boldest surgeon would shrink; his results were extraordinary, and I yield to no one in his honor. The present trend of medicine gives to the general practitioner a field in which his opportunities are unsurpassed and for which the training of the medical schools to-day amply fits him namely, the field of diagnosis. The medical student to-day, so far as I have to do with him, is taught obstetric diagnosis first, and then what not to do, quite as much as what to do, and when to summon the competent obstetrician.

Dr. John B. Deaver, Philadelphia: I can answer the protest against opening the uterus if a diagnosis can't be made otherwise only by protesting against leaving the uterus unopened when a diagnosis cannot otherwise be made. Dr. Norris agrees that there are indications for this operation. As sane a man as Dr. Norris could not look at it from any other point of view. There is a type of disease of the uterus which no man can diagnose without resorting to the procedure I have recommended. What is the attitude of the surgeon to-day in upper abdominal disease? Is it possible to diagnose every upper abdominal condition before the abdomen has been opened? What does the exploratory operation reveal?—the true pathologic condition. Is it not a more honest, just, conscientious course to pursue than to deceive your patient by looking wise, getting a consultation fee and making them think that you know it all? Those who assume

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this position are dangerous doctors and capable of doing much harm in their community. We are no further along in the treatment of cancer than we were many years ago. We must operate in the precancerous stage, and those who are not doing as I and others advise in this respect will continue to write certificates of death, the result of latent cancer. Any one who uses laminaria tents to dilate the uterus invites infection. Any one who knows anything knows he cannot dilate the normal uterus with the finger for thorough exploration; this is an unanatomic, unphysiologic, illogical and unsound statement. The surgeon, I grant, who possesses the tactus eruditus is more fortunate than his brother who has never acquired it. Dr. DeLee sounded a note as to the laity educating the doctors. From what I have heard this afternoon I think it is high time that the laity educated the gynecologists.

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EXPERIMENTAL AND CLINICAL STUDIES OF COLON STASIS

JOSEPH RILUS EASTMAN, M.D.
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The subject of colonic toxemia may be studied under four headings: (*a*) colitis; (*b*) adhesions, membranes and kinks; (*c*) colon dilatations and visceroptosis, and (*d*) stasis. The solution of many vexed questions of alimentary toxemia may with good reason be sought in an understanding of the mutual relationship of these factors.

In examining the region of the terminal ileum, cecum and ascending colon of a large number of dogs, it is observed that this area is almost invariably the site of peri-intestinal inflammation with a notable tendency to the formation of membraniform adhesions. Such membraniform adhesions are very common in apparently healthy dogs. The vermiform appendix in the dog, as is well known, is very large, being virtually an elongation of the cecum. This abnormally large appendix is usually found to be tightly filled; likewise the ascending and transverse colons are more or less engorged at nearly all times in the healthy dog. Manifold membranous adhesions bind the appendix to the terminal ileum or to the ascending colon. In several specimens the appendix was sharply angulated at two or three levels by contracting membranes or bands. Often the terminal ileum was found to be enveloped in such membranous adhesions. On microscopic examination of the colon wall opposite these adhesions, complete evidence of chronic colitis was found in each case. The goblet-cells and the lumina of tubules were engorged with mucus. The intertubular

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spaces were infiltrated with round cells and the polyblasts of Maximow were seen in nearly every field. The small blood-vessels were congested. Colon stasis in the dog is almost constant. Thus it appears that the factors mentioned before, adhesions, membranes and kinks, colitis and stasis are to be observed in nearly every dog. What is the relation between the adhesions, the stasis and the colitis?

I have produced in rabbits a colon stasis by prolonged intermittent ligation of the anus, and such an artificially induced colon stasis resulted after a few weeks in the formation of plastic adhesions which were drawn out into membrane form by the normal movements of the large intestine. These membraniform adhesions appeared most frequently about the cecum and at the hepatic and splenic angles.

A great many writers, including Virchow, Gerster and Pilcher, have expressed the belief that plastic adhesions may form about the colon as the result of a toxemia having its origin within the lumen of the large intestine. In view of these things it does not seem illogical to say that membranous adhesions about the colon may result from stasis with associated chronic colitis.

Bassler[1] describes a bacterium which he believes is an important factor in the development of pericolonic adhesions and calls it the *Bacillus adhaesioformis*. He examined the adhesions in eleven cases and encountered this bacillus more often than any other. Runeberg and Heyde isolated eleven different bacteria in inflammatory conditions about the vermiform appendix, among them the *B. fusiformis, B. thetoides, B. butyricus, B. parapneumococcus, B. pseudotetanus* and the *Streptococcus anaerobicus*.

It should be noted that the *B. adhaesioformis* of Bassler was not found in the adhesion but in the intestinal lumen opposite the adhesion. Like the bacilli

1. Bassler, Anthony: Med. Rec., N. Y., 1914, lxxxv, 427.

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isolated in adhesion formation by Runeberg and Hyde it is an anaerobe. The presence of these anaerobes in the colonic lumen at the site of adhesion may be accounted for by recalling that it is at the site of adhesion that stasis is marked. These saphrophytes or dung-dwellers are present in the stagnant feces, the oxygen of which is gradually consumed by the *B. coli;* thus a medium favorable for the growth of the anaerobes named is established. It can hardly be regarded as proved that any of these bacteria bear a specific relation to adhesion formation. If these anaerobes, however, do bear a direct or indirect causative relation to adhesions and colitis, stasis by the arrest of feces will favor, through the agency of these bacteria, the development of colitis and pericolitis.

Adami[2] remarks that bacteria pass from the intestine to the peritoneal cavity with comparative ease, and when present locally in any number and of low virulence they tend to be destroyed by the inflammation which they set up so that the fully formed adhesions are sterile. Adami, therefore, supports the contention that stasis through the agency of bacteria may produce pericolonic membranes. On the other hand, membranes, bands or folds which in any way fetter or embarrass the movements of the large intestine will tend to cause stasis. Among these bands and folds are many which are of embryonal origin. Many result from traction on adhesions between appendices epiploicae and adjacent intestines (Douglas G. Reid).

It is true that pericolonic adhesions and membranes do not always produce stasis; and here it should be noted that the clinical consequences of pericolonic membrane formation will vary according to the variety and extent of the pericolonic membrane which is present. The white fibrous embryonal fusion membrane passing from the mural serosa to the colon is almost sure to hamper the normal cecal movements, whereas,

2. Adami, J. G.: Brit. Med. Jour., Jan. 24, 1914, p. 177.

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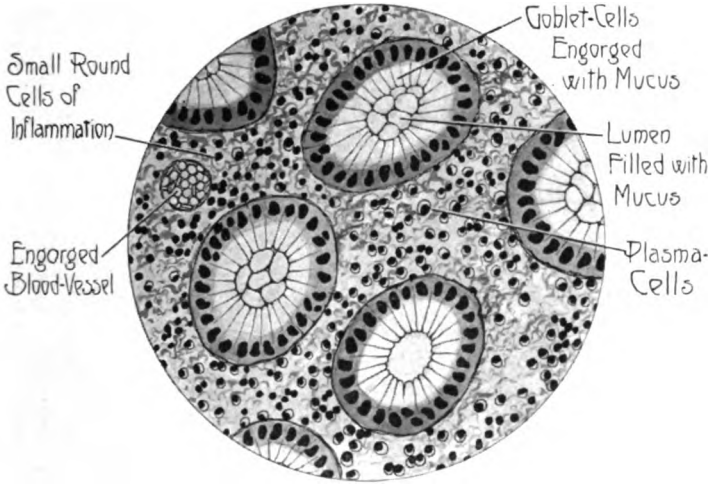

Fig. 1.—Colitis as seen in association with colon stasis.

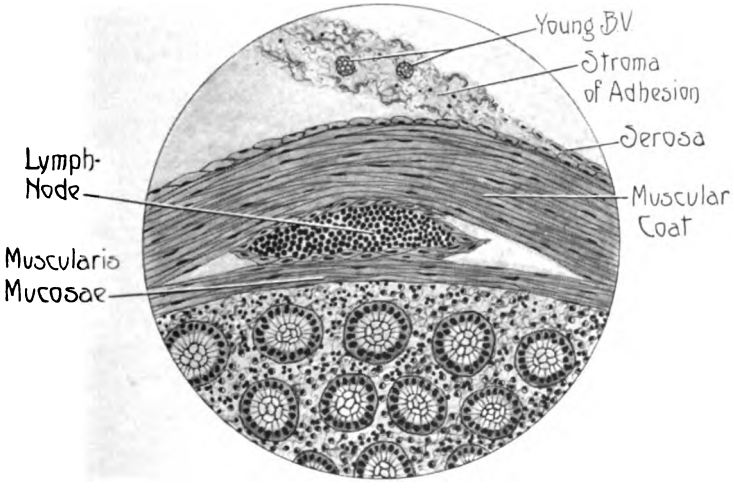

Fig. 2.—Marked colitis as observed opposite pericolonic adhesion.

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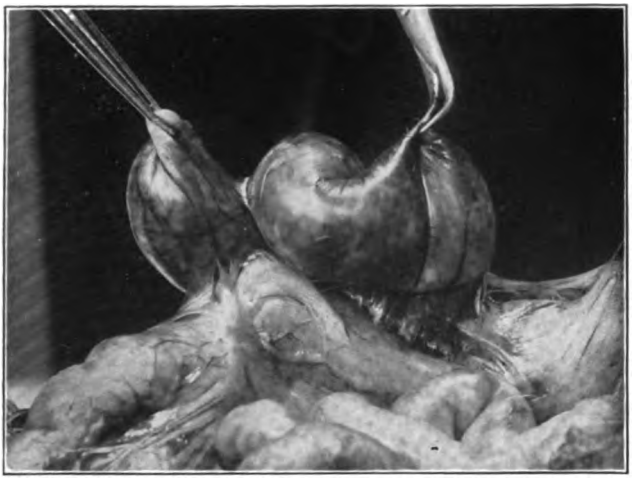

Fig. 3.—Extensive pericolonic adhesions such as are almost constant about caput coli in dogs.

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the gossamer vascular veil, a very common accompaniment of chronic appendicitis and probably the result of changes in the circulation (Hertzler), I have found frequently in young persons, unassociated with constipation in any form or degree. This, however, does not prove that they bear no relation to stasis. Such diaphanous membranes may be present without compression or strangulation of the colon, in which case they have only a potential clinical significance. Often, however, such veils probably cause or aggravate the condition of stasis.

I have been greatly surprised at the frequent incidence of this delicate vascular form of pericolonic membrane. It may be found in some form or degree about the cecum in nearly every case of chronic appendicitis with stasis. That is, a thin vascular extra peritoneum may be slipped over the underlying serosa in, I believe, at least 75 per cent. of cases of chronic inflammation of the vermiform appendix. I have demonstrated it in twenty-six consecutive cases of chronic appendicitis with constipation, which observation suggests that the movable vascular veil bears the relation of cause or effect to the chronic appendicitis. The interference with drainage caused by the membrane, doubtless, predisposes to appendicitis.

I have found the appendix when buried under a pericolonic membrane to be greatly reduced in caliber, resembling a very slender cord, white and almost bloodless. Occasionally the first proximal inch of the appendix was of normal size, but the filiform strand beneath the adhesions or membranes was of a cross-diameter of only 2 or 3 mm. It is not proved that this form of membrane is always of fetal origin. It seems more probable that it is a result of irritation or infection, developing either in fetal or adult life; but, however that may be, an appendix thus strangulated could hardly drain normally.

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Pericolonic adhesions nearly always give rise to disturbances of one kind or another. The constriction and fixation of the intestine produce not only a mechanical distortion inducing stasis and colitis, but certainly in some cases, by establishing abnormal functional conditions, give rise to aberration in the behavior of the gastro-intestinal tract through the agency of reflex action. Thus in some instances, as Hewes has explained:

> Spasm or abnormality of peristalsis of portions of the gut, stasis of contents or gas, may occur in portions far removed from the actual seat of the lesion without the finding of any anatomical variation in the portion where the function is disturbed. For example, disturbances of the stomach, with imperfect emptying of contents, may occur in cases where no distortion of the stomach or duodenum is present, and where the only abnormality found is adhesions about the cecum and stasis of contents.

Like many others I have occasionally been able to relieve colon stasis permanently by division of an enveloping pericolonic membrane, which fact, though it may not prove that the membrane produced the stasis, is at least strongly suggestive. It seems reasonably fair in view of the foregoing data to say that pericolonic membranous adhesions may induce colon stasis, and on the other hand, as a direct result of colon stasis, bacteria may penetrate by exosmosis the coats of the bowel and develop pericolonic adhesions, an instance of vicious circle.

A somewhat similar interchange of cause and effect is presented in the condition of descensus of the colon. If from any cause, such as decrease of intra-abdominal pressure due to relaxation of the lower abdominal musculature, a ptosis of the transverse colon develops, it is clear that the procession of intestinal contents through the V-shaped transverse colon will be slow. It is equally clear that the retardation of the bowel contents in the sagging transverse colon will tend to maintain or increase the ptosis. Thus, we see how stasis leads to ptosis and ptosis leads to stasis.

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A specific illustration of downward displacement of the colon, probably acting as a causative agent of stasis, is represented by the cecum mobile of Wilms. The column of contents of the loaded ascending colon by its weight and hydraulic pressure dilates and pushes the cecum downward into the pelvis. The condition of cecum mobile noted results, and as the direct effect of the ptosis and the fatigue of the muscularis of the cecum which empties itself, according to Jackson, like a bulb, stasis becomes more extreme, then comes emigration of bacteria and toxemia by exosmosis, and pericolonic membranous adhesions are formed and another vicious circle is completed.

Colitis seems to be a quite constant accompaniment of stasis and colon ptosis. Sections made by Dr. A. C. Shipp, pathologist of Indiana University, from the human colon wall in cases of chronic stasis in which a short-circuiting operation was performed, disclose, as in the apparently normal dog, chronic colitis evidenced by the presence of plasmatocytes with eccentrically placed nuclei, distended goblet-cells, congested blood-vessels and round-cell infiltration. Colitis may with reason be suspected of causing or increasing stasis. Infiltration of the colon wall decreases its elasticity and contractility and proportionally decreases its propulsive power.

Thus, it appears that each of the elements, stasis, colitis, adhesions or ptosis, may cause any or all of the other three elements or may be caused by any or all of the other three. If this be true, intelligent treatment of any or all of these factors must be based on an understanding of this mutual relationship which takes the form of several correlated vicious circles.

The treatment of colon stasis, by the very nature of its varying causation, must vary according to the peculiarities of each case. Purely medical treatment with petroleum oil, Weir Mitchell feeding after Coffey's plan, which has in view an increasing of the

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abdominal fat and medical treatment aimed at the arrest of intestinal subinfection, all have an important part in the treatment of intestinal stasis. Hygiene. still more.

As to the surgical treatment of colon stasis, it may be said that this subject is not yet *sprachreif*. Numerous operations have been devised for the correction of the various causative factors concerned in the arrest

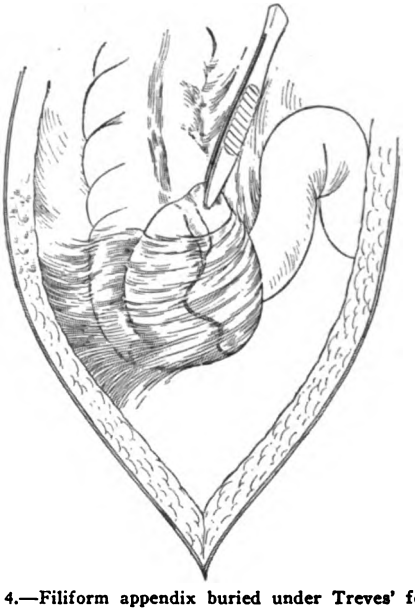

Fig. 4.—Filiform appendix buried under Treves' fold.

and stagnation of the intestinal contents. Among the procedures are those of Robert C. Coffey and C. A. L. Reed for the restoration of the ptosed colon to its normal position, and those of Sir Arbuthnot Lane, whose best-known operative exploits are based on Metchnikoff's view that we are better off without a colon.

The surgical procedure to be employed in any given case should be determined not before operation, but

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after the abdomen has been opened and completely explored. The operation must be made which will most efficiently correct or remove the anatomic or physiologic abnormality which is causing the stasis. In midline ptosis this may mean the hammock operation of Coffey or his operation to increase the capacity of the upper abdomen. In the case of discrete simple band or membrane formation it may mean nothing more than the division or removal of the band or

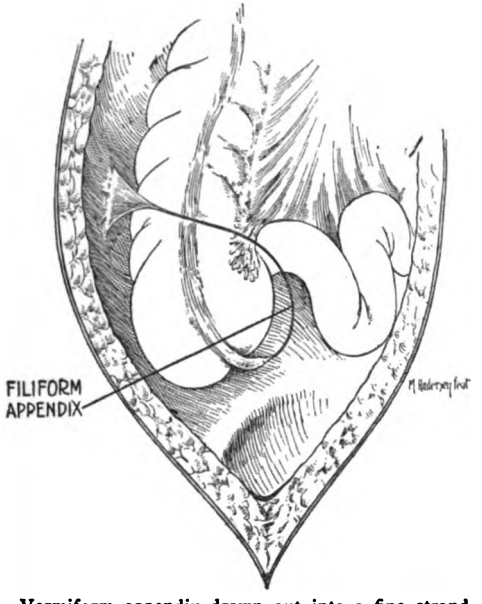

Fig. 5.—Vermiform appendix drawn out into a fine strand, adherent tip drawing out a small membrane from mural peritoneum.

membrane. In the case of a colon so fettered and constricted by pericolonic membranes that it cannot be freed by division or removal of the membrane, or in a colon so hopelessly ptosed that suspension operations cannot be efficient, then colectomy or a short-circuiting operation or both combined are to be considered.

Little or nothing is to be expected from operations for the removal of pericolonic membranes which are

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at all extensive. I have attempted this many times and my results do not justify continuance of the practice. If one can definitely divide or remove a constricting band or membrane and cover the raw surface which is left, as can be done occasionally, then the operation is justified. Otherwise, it is to no purpose. The leaving of large, denuded areas is sure to be followed by unfavorable results.

If short-circuiting is to be done, great care should be exercised in selecting the colon surface to be anastomosed.

Mr. Lane places the ileum or cecum against a convenient segment of the sigmoid and the two structures are united, thus throwing 4 or 5 feet of the offending colon out of commission. This method, although easy of execution, is followed in a considerable percentage of cases by fecal regurgitation and impaction.

Case has shown by numerous Roentgen examinations of patients on whom ileocolostomies had been done that the terminal ileum had become a veritable cecum, often dilated and impacted.

Hamilton Drummond made roentgenograms of patients after ileocolostomy and found a definite dilatation of the terminal ileum. The loop of ileum between the anastomosis and the cecum seemed to have taken over to some extent the function of the colon.

Anastomosis of the caput coli at its lowest level with the rectum presents all of the advantages and eliminates some of the evils of ileocolostomy. Ileosigmoidostomy does not efficiently drain the cecum. It has been shown by Mr. Lane in cases in which colectomy had been performed after an ileocolostomy, that the cecum was tightly impacted.

If the caput coli be anastomosed freely to the rectum at the lowest point possible without traction, then the reversed peristalsis of the ascending colon should favor drainage of the cecum through the artificial

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opening in the floor of the pouch, which is the chief habitat of ammoniacal food and intestinal bacteria of decomposition, and which even in starvation is not entirely empty (Cannon).

The opening of communication should be amply large. In order that the anastomosis may be made on the most dependent surface of the caput coli, the appendix, though normal, if in the way of anastomosis or good drainage, should be removed. If the sigmoid is dilated and very redundant it should be resected in order that coils of incompetent sigmoid may not remain above the stoma.

It is probable that the Roentgen examination of patients on whom short-circuiting operations have been made will continue to afford surprises. My own experience with such examinations has been both interesting and instructive. It has been the rule that patients operated on after the technic described above have experienced prompt relief, even in cases in which the colon impaction had caused distress for years. In a few cases the bowels began moving daily without stimulation of any kind.

When the serial roentgenograms were made after such an operation for stasis without extensive adhesions in which complete relief had been secured, and while the patient was still in the hospital, I found that the bismuth column did not pass from the cecum through the anastomosis opening as I had hoped it would. The first roentgenogram, made twelve hours after the bismuth meal was taken, showed the cecum filled with bismuth, and subsequent examinations showed the bismuth column rising to the hepatic flexure. Serial pictures made up to twenty-four hours revealed bismuth in the transverse and ascending colons. These pictures were made two weeks after operation, when perhaps the margins of the anastomosis opening were still somewhat indurated and unyielding. A week later, or three weeks after opera-

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tion, roentgenograms showed that the bismuth column after reaching the cecum passed partly through the anastomosis opening, though the greater part arose in the ascending colon as before. In cases with more extensive adhesion formation and with lifeless colon muscularis, the proportion of colon contents passing through the stoma was greater. The Roentgen examination of such cases has shown how little we know of the hydrostatics of the colon. It seems clear that gravity plays little or no part in the course taken by the colon contents, intra-abdominal pressure having a much more important rôle.

The improvement following short-circuiting operations is probably due in some measure to the relief of colitis with consequent relief of the associated factors mentioned previously. Direct drainage by allowing escape of bacteria-laden secretions leads to improvement in the colitis with consequent increase of propulsive power and proportionate decrease of stasis. This is a probability in stasis cases in which the colon is not completely fettered by firm adhesions. Unless the colon is thus hopelessly enveloped in dense membranes, the purpose of a well-planned short-circuiting operation should be, not to put the colon out of commission, but by relief of colitis and pericolitis *through drainage to put the colon back in commission.*

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THE CONDITION OF A FEW PATIENTS, TWO YEARS AFTER ILEOSIGMOIDOSTOMY

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The profession in its attitude toward the treatment of ptosis of the stomach and colon may be divided into three classes: (1) those who think that any benefit to be derived from operative procedures depends on the shock given the nervous system by the operation, together with the suggestion of benefit received; (2) those who believe in trying to restore the viscera as nearly as possible to their normal position by various methods, and (3) those who believe in overcoming the effects of displacement by short-circuiting the intestinal tract.

I have been inclined to believe that all three views are correct, and that the difference among them is largely a matter of degree of disability of cases observed. The mildest cases can be much improved by diet, proper rest, exercise and suggestion and almost any operation followed by a few weeks of rest will seem to benefit the patients. Cases of the next class are more severe, and cannot be relieved without some operation that assists the bowel in emptying itself. These various operations for restoring the bowel more or less completely to its normal position answers the purpose for this class. In the third class the large intestine has become so elongated and attenuated that to fasten it up in two or three places increases the number of kinks and does not sufficiently overcome the difficulty of evacuation to enable the bowel to regain its tone.

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In support of this view I may say that often the Roentgen ray shows marked displacement of the colon while yet there exists no particular disturbance of its functions. It is my rule when opening the abdomen for any cause to note the location and condition of the colon, just as I examine the gall-bladder and appendix. In many cases I have observed a well-marked displacement, and the history of the case indicated that stasis had existed for considerable length of time, but in the vast majority of cases the patient has improved in this regard after the operation, which was in no way directed to the relief of symptoms on the part of the colon.

As most of these patients are admittedly neurotic, the results of any given procedure can be estimated at their true value only after a lapse of some time. The following cases of ileosigmoidostomy are reported to show the results after two years, which I think is a length of time sufficient to give some idea of the permanency of any relief that has been obtained. The cases are too few to be of much value in and of themselves, but if a hundred other operators will likewise report their cases the statistics will be of real value.

Case 1.—Operation was performed at the Good Samaritan Hospital, Jan. 15, 1912. I reproduce a previous report[1]: The first patient I saw with my friend and colleague, Dr. Carothers. She was 31 and unmarried. Up to the age of 20 her health was comparatively good, with the exception of painful menstruation, for which she was twice curetted without relief. At the age of 28 the abdomen was opened and the left ovary and appendix removed. After this the patient's health was only fair; she had headaches and ill-defined pains continuously, for which she consulted internists, orthopedists, oculists and rhinologists. When I saw her she was absolutely unable to work and manifested in a marked degree all the symptoms of colonic stasis. She was afraid to eat on account of the difficulty experienced in evacuating the bowels. Before the operation this patient had not had a stool without the use of strong purgatives for over five years. On the third day following the operation the bowels moved of their own accord and continued to do so up to the present

1. Bonifield, C. L.: Ileosigmoidostomy for Colonic Stasis, Am. Jour. Obst., February, 1913.

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time. For the first week the stools were rather too frequent and loose and irritated the skin around the anus. Since that time the condition of the bowel has been quite satisfactory.

The patient has gained 15 pounds and has been following her work as a hair-dresser and solicitor. Her skin has cleared and her general health improved in every way, and is much better than she had ever been previous. She occasionally is slightly constipated, but an enema is all that is necessary to relieve her.

Case 2.—Miss S. came to me on account of "stomach trouble." She had constant pain in the abdomen and was absolutely unable to work. I could scarcely get her to take enough food to nourish her on account of the distress it gave her. Her bowels moved only with violent purgation. After a month's observation and treatment I advised operation and she immediately consented. The operation was performed and her bowels moved on the third day without any assistance and were rather too loose. Within a week she was eating better than she had for years. Once since she went home she has been slightly constipated, but this was from drinking large quantities of milk.

This patient was in my office within the last month. She came, however, to ask my advice as to the diet for her baby. Six months after the operation she married and in due time delivered a healthy child at full term without any trouble. She nursed her baby with satisfaction to the child and without interfering with her own nutrition. She can now eat anything she wants and calls herself a well woman.

Case 3.—In the case of Miss G., aged 35, menstruation began at the age of 13, and was irregular the first year, later becoming regular and painful. She had suffered from constipation as long as she could remember. She complained of ill-defined pains over the abdomen. She had periods of most profound melancholia and fits of uncontrollable temper. She had worked as a dress-maker but was forced to give up on account of her health. She was treated by a general practitioner of ability, but he diagnosed her case as hysteria and treated her without sympathy and without benefit. Her mental condition was getting worse. I saw her in consultation. Physical examination showed the uterus not well developed, with a long narrow cervix, sharply anteflexed. A fibroid the size of a hickory-nut was present in the anterior wall of the uterus. I advised a thorough dilatation of the cervix, curettage and packing of the uterus, followed by several weeks of rest in bed in a hospital. The large doses of purgatives necessary to move the bowels exhausted her. After two weeks in the hospital I saw that I could not improve her condition any further by rest and changed surroundings. She was sent home and ordered to walk several

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squares every day, eat large quantities of fruit before breakfast, and take cold sponge-baths. Several times a day she was to exercise by bending forward till her finger-tips touched the floor and then straightening up. Under this regimen she about held her own, but made no further progress. It took 10 grains of compound extract of colocynth with 5 of cascara to move her bowels. Dr. Dudley Webb made roentgenograms of the stomach and intestines, showing ptosis of the colon and slow motility. She returned to the hospital, and on May 22 I did an ileosigmoidostomy and also removed the small fibroid. The bowels moved on the third day without a purge.

The patient was in my office last week; she is the picture of health, with skin clear, eyes bright and a constant smile on her face. She has gained 65 pounds. She has been clerking in a jewelry store and has not missed a day of work since January 1. Only once this year has she found it necessary to take an enema.

Case 4.—Mrs. G., aged 38, German, was exceedingly nervous and unable to work, with ill-defined pains over body and discolored skin. Patient was always constipated, giving a history of taking large quantities of Epsom salts before being able to obtain even a slight bowel movement.

Six months after ileosigmoidostomy she reported as being greatly benefited. A letter received within the last week says that she has not gained much in weight and that occasionally she has to take a purgative. There is evidently considerable improvement in this case, as the patient is able to do all her housework, including the washing for a large family, which was entirely out of the question before operation.

Case 5.—Mr. C. had been a neurasthenic all his life. Constipation in this case was also so severe that it took large doses of purgatives to move the bowels. He suffered greatly from headaches, which completely prostrated him. He had no appetite; there was a marked discoloration of the skin, due to intestinal absorption. The Roentgen ray showed the colon in fairly good position but a greatly elongated sigmoid. Ileosigmoidostomy was done at Bethesda Hospital, the ileum being attached as low as possible.

The patient's body-weight remains practically the same. His bowels move without any trouble, but occasionally he has to take a purge. His headaches are less frequent and less severe. His color is greatly improved and his nervous symptoms decidedly better. I received this report from his family physician this past week.

Case 6.—Miss R., a neurasthenic of the worst type, was operated on at Bethesda Hospital, Nov. 2, 1911. The uterus

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was curetted and the right ovary, which was cystic, removed. At this time I noted that the colon was elongated and prolapsed. After the operation she did not improve as I expected her to do, so I advised the ileosigmoidostomy. The following July (1912) during my absence from the city Dr. Carothers performed this operation. She immediately improved and her family physician, Dr. Cadwallader, reported to me this last week that the improvement has been lasting.

It would seem that the results are most satisfactory in the patients who live in the city where I could see them occasionally and give them advice as to diet, etc.

These are all of the cases that I have been able to follow for a full two years or more. The cases are too few to justify drawing any definite conclusion, yet straws show the way the wind blows and I shall continue to perform the operation in carefully selected cases. I have carefully avoided trying to swell my list of cases by doing the operation when it was not absolutely necessary. I would not advise the operation in any case until the ptosis has been demonstrated to exist and the Roentgen ray and bismuth have shown as well that there is a marked retardation of the fecal current; and then it is wise to have a good internist see how much improvement he can secure by diet, exercise, etc. When all other methods have failed, however, I believe this operation has a distinct place in surgery.

In many cases this advanced condition has been warded off by proper treatment while the patient is still young. Other patients, while they may not be cured, can be greatly benefited by exercise, diet and improvement of the general health and particularly the nervous system. So it can be seen that I believe that the cases in which this operation is indicated are comparatively few. I hope in the future a better understanding of the etiology of the condition will enable the family physician to make the cases still fewer. In the meantime, however, I think we can by the judicious use of this operation restore some people to their proper useful sphere in the world.

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RESECTION OF THE FIRST PORTION OF THE LARGE INTESTINE AND THE RESULTING EFFECT ON ITS FUNCTION

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Human beings vary in their internal anatomy in about the same degree that they vary in their external form and configuration. Were a man who was thin and 6 feet high to ask us to make him fat and 5 feet 6 inches high by operating on him, we would think him mentally deranged. Yet how frequently in the past have we attempted to correct surgically the internal anatomy because of variations from the average normal, especially the position of the abdominal viscera.

It is less than ten years since nephrorrhaphy, ventrofixation, gastrorrhaphy and kindred operations were resorted to on indications which would not be accepted to-day. We have come to appreciate the fact that comparatively few of the abdominal viscera have unchangeable anatomic characteristics and that variations within limits are not to be considered abnormal.

The large intestine, with its short heredity and changing function, has no such fixed characteristics as have the more primitive small intestines. Arising on the left side of the body, the head of the colon swings to the right but does not reach its normal habitation until after birth. The peritoneal cavity has then already been formed and its attachments on the right side may take on the character of adhesions, in many instances causing that condition which Jackson[1] has

1. Jackson: Tr. Western Surg. and Gyn. Assn., 1908, xviii, 269.

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so aptly termed a "veil." This looseness of attachment of the ascending colon and hepatic flexure permits of freer movement of the right kidney. The terminal ileum normally comes up out of the pelvis and enters the cecum at an acute angle. The ileocecal valve is a sphincter mechanism acting to hold the ileal contents and delay their progress, and this stasis within limits is normal. Early in fetal life the ileum becomes attached to the inner side of the cecum. This fixation prevents expansion on the inner side and, because of its inability to expand in all directions, the cecum assumes a lopsided appearance. An exaggeration of the sustaining bands is often called ileal kinks.

The large intestine, within normal limits, varies in length and position, especially the transverse colon and sigmoid. The high fixation of the splenic flexure of the colon, economically taking the place of a muscular sphincter, is a fixed characteristic and performs an important function. It holds within the proximal half of the large intestine the ingesta which have been passed into it from the small intestine and delays their progress that fluids and nutritive material may be absorbed therefrom. When the waste remnants move beyond the splenic angle they pass rapidly through the descending colon, which acts as the vestibule to the sigmoid, the normal fecal container. As pointed out by Rokitansky[2] more than sixty years ago, the descending colon is normally empty.

Usually when we speak of the cecum we mean the cecocolon or head of the colon which includes the cecum, ascending colon and hepatic flexure. The cecum itself is the end-pouch only and is but from 1½ to 3 inches in length.

It is altogether probable that in the past too much importance has been attributed to purely incidental changes in the position and attachments of the large intestine. Bands, kinks and adhesions of a normal

2. Rokitansky: Handbuch der spec. path. Anat., 1842.

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character have been given a fictitious rôle in the supposed production of symptoms which were not in themselves mechanical. Adhesions, bands and kinks are not usually congenital in the sense that they are formed prenatally and then remain as formed, but they change in character throughout life. The interesting work of Lane,[3] Pilcher,[4] Gerster,[5] Gray,[6] Pringle,[7], Binnie,[8] Jackson,[1] Eastman,[9] Flint[10] and many others has thrown much light on the origin of these bands. We are indebted to the pioneer work of Lane for calling our attention to the fact that in the large intestine may lie the cause of much human misery. While I do not agree with Lane in the great stress which he lays on the rôle of bands, kinks, etc., I am convinced that he has discovered a great physiologic truth not heretofore recognized, and he must be fully credited with bringing forward this most important question. Whether or not we agree with him, we must at least recognize the facts on which his contention rests.

The villi of the small intestine are to man as roots to a tree. In early fetal life the first half of the large intestine contains villi the same as the small intestine; and while these villi in later development are lost as anatomic structures, the power of absorption remains. We speak of rectal feeding as though food were actually absorbed in the rectum. As a matter of fact, food or other material placed in the rectum is promptly carried by reverse peristalsis toward the head of the colon for absorption and assimilation.

What is the function of the large intestine? Beyond the splenic flexure it is to a great extent a storage organ. But proximal to the splenic flexure the colon,

3. Lane: Brit. Med. Jour., May 4, 1912, p. 989; Surg., Gynec. and Obst., November, 1910, p. 495; Lancet, London, Dec. 21, 1912, p. 1706.
4. Pilcher: Ann. Surg., January, 1912, p. 1.
5. Gerster: Ann. Surg., 1911, liv, 325.
6. Gray: Brit. Med. Jour., Jan. 24, 1914, p. 177.
7. Pringle: Brit. Med. Jour., Jan. 24, 1914, p. 183.
8. Binnie: Month. Cycl. Pract. Med., 1905, xviii, 341.
9. Eastman: Surg., Gynec. and Obst., April, 1913, p. 341; ibid., February, 1914, p. 228.
10. Flint: Johns Hopkins Hosp. Bull., October, 1912, p. 302.

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Fig. 1.—Anatomy of the lower ileum and first half of the large intestine.

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Fig. 2.—Division of the peritoneum which binds cecum and ascending colon to the abdominal wall. Retro-duodenum, spermatic vessels and ureter exposed.

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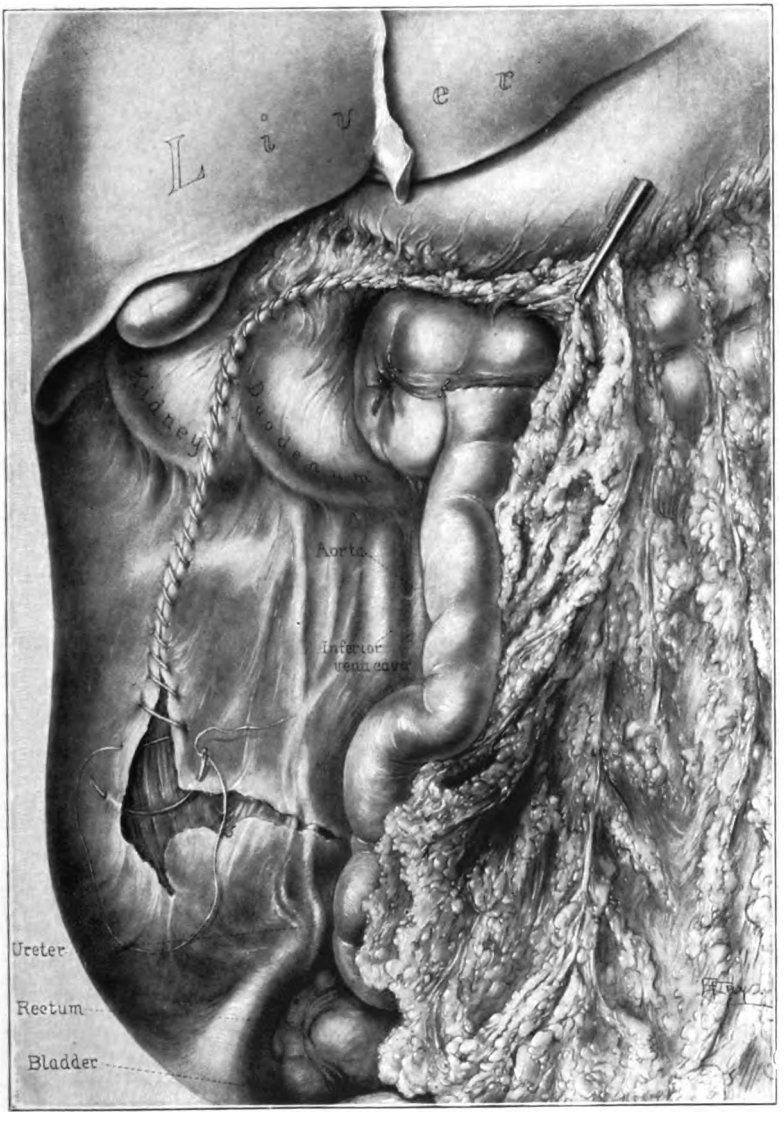

Fig. 3.—Result after removal of 10 inches of ileum, appendix, cecum, ascending colon, hepatic flexure and one-fourth of transverse colon. End-to-side ileocolostomy. Running suture closing peritoneum of posterior wall.

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and especially the cecocolon, has a most important assimilative function. We know that in the carnivora the large intestine is small as compared with its great size and importance in the herbivora. In the herbivora the large intestine and especially the cecocolon may be compared to a silo in which fermentation of vegetable matter takes place, freeing nutritive material of the greatest value.

The function of the appendix, a part of the large intestine, is practically unknown. The organ in man has been looked on as the vestigial remnant of a herbivorous cecum. Keith[11] dissents from this view, believing that the appendix is a lymphoid organ having a function comparable to that of the tonsil and solitary follicles of the intestine. Ribbert[12] has demonstrated that beginning at adolescence a progressive involution takes place in the appendix, and that in persons at the age of 50 one-half of all appendixes show age characteristics. An appendix which would be normal in a person at 50 years would be abnormal in a child. The same may be said of the tonsil.

C. H. Mayo,[13] in 1903, pointed out the surgical significance of the progressive atrophy of the lymphoid structures of the body after adolescence, thus explaining why cancer in old persons does not spread with the rapidity it does in youth because of the atrophy of the lymphatics.

We must therefore look on the appendix as a lymphoid organ which in early life has some value in connection with cecocolic metabolism. It is interesting to note that in the carnivora, which do not have an appendix, lymphoid tissue of the same nature as that found in the appendix is to be found at the apex of the cecum, the site of the appendix were it present.[14]

11. Keith: Lecture, Royal College of Surgeons, October, 1913.
12. Ribbert: Virchow's Arch. f. path. Anat., cxxxii, 66.
13. Mayo, C. H.: Tr. South. Surg. and Gynec. Assn., 1903, xvi, 442.
14. Corner: Ann. Surg., 1910, lii, 512.

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It has been suggested that the appendix may through chronic inflammation vaccinate the patient against subsequent colon infections.

Reasoning from analogy, we can say that the functional activity of the proximal half of the large intestine concerns vegetable intake. It has been shown that within 100 years the flesh intake of man has increased four times.[15] The decomposition of unassimilated flesh food develops poisonous substances. It is reasonable to suppose that when these end-products are passed into the large intestine, which has developed to a full extent only the power of caring for vegetable material and fluids, such products may be absorbed, thus disturbing the sympathetic balance and producing many of the symptoms which we speak of in our ignorance as neurasthenia, and which sometimes have been thought to be the result of mechanical conditions, bands, kinks, etc. In this connection, a peculiar type of constipation with a thin-walled bowel with no abdominal distention may frequently be noted. The abdomen is soft and silent as compared with that encountered in true mechanical obstruction with its intestinal stiffening, colic and abdominal distention. The general condition of the patient often well illustrates this sympathetic disturbance. A severe case may even resemble an exophthalmic goiter, for which it may be mistaken. Why may not these persons be cured by a purely vegetable diet? When we consider that man as a species is at least 500,000 years old and that his present characteristics have slowly evolved—so slowly, indeed, that the evidences of prehistoric man show him anatomically to be essentially the same as to-day—the futility of attempting to change during the lifetime of a single individual the whole history of race metabolism is evident.

Adami[16] objects emphatically to the use of the term "auto-intoxication," since proof of such process is

15. Armstrong: Brit. Med. Jour., July 8, 1905, p. 68.
16. Adami: Brit. Med. Jour., Jan. 24, 1914, p. 177.

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lacking. He believes that a low grade of bacteriemia with a local *subinfection* of various vital organs is responsible for the disturbance, and in this he is probably correct in most cases; but obstruction of the bowels produced experimentally by Whipple, Stone and Bernheim[17] shows the poisonous effect of the secretions of the upper jejunum and duodenum when acutely blocked, independent apparently of infection, an effect which these authors speak of as an "intoxication." Clinical experience in acute intestinal obstruction as it occurs in man seems to bear out these experiments. For this reason a high enterostomy in acute intestinal obstruction gives quicker and surer relief than one down closer to the actual point of obstruction.[18] Vaughan,[19] in his notable work on protein metabolism shows the specific character of the poisonous effects which are produced by failure properly to split up proteins and their relation to food idiosyncrasies and anaphylaxis.

Hypersecretion or hyposecretion of the thyroid and hypophysis and the various other glands of internal secretion may have its counterpart in like conditions of the glands of the intestinal mucosa. In lieu of a more expressive term and in the absence of a scientific explanation of the clinical phenomena, intoxication may be used temporarily as a term to express the hypothetical condition. Intoxication is at least a graphic term for these conditions, meaning the absorption of chemical substances, no matter how produced; substances which may be absorbed without leaving in their path infective lesions in the mucosa of the intestine at the place of absorption or resulting in the bacterial invasion of organs.

Putting aside for the moment these anatomic and physiologic considerations, I wish to discuss the effect of the removal of the cecocolon, first, as a means of

17. Whipple, Stone and Bernheim: Jour. Exper. Med., February, 1914, p. 144.
18. McKenna: Surg., Gynec. and Obst., December, 1913, p. 674.
19. Vaughan: Protein Split Products in Relation to Immunity and Disease, Philadelphia, Lea & Febiger, 1913.

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physiologically limiting absorption, and, second, as to its effect on the storage function of the bowel, that is, on constipation. These two conditions go hand in hand: namely, so-called stasis of the large intestine with a train of nervous derangements and constipation. In 1900, I reported[20] some cases of obstinate constipation which had been cured by an enlargement of the ileocecal orifice, and suggested that constipation may be many times primarily dependent on constipation of the small bowel; that food products might be retained in the small intestine for too great a length of time and not furnish the necessary chemical stimulation to activate the large intestine. I am convinced that the observations which were made at that time and which have been continued in the intervening years were essentially true, and that we may go still further and say that retention of these products not only in the small intestine, but in the cecocolon has a similar effect in diminishing the stimulation to action in the storage-half of the large intestine. Lane,[21] by means of ileocolostomy, has apparently demonstrated the value of this stimulation and its effect not only on constipation, but also on the metabolism of the individual. Hertz and Newton[22] have shown that food intake furnishes a gastro-iliac reflex and the ileocecal valve opens and allows the lower ileum to empty its contents. A gastrocolic reflex occurs simultaneously and the cecocolon forces its contents onward. It is possible that the ileocecal valve is controlled by the cecocolon just as the pylorus is controlled by the duodenum. Ileocolostomy, however, in a certain percentage of cases, especially in adults, leads to an impaction in the disused colon through reversed peristalsis, and thus in some cases to a continuous absorption of poisonous products quite as though ileocolostomy had not been performed.

20. Mayo, W. J.: Ann. Surg., 1900, xxxii, 364.
21. Lane, W. A.: The Operative Treatment of Chronic Constipation, New York, Paul B. Hoeber, 1909.
22. Hertz and Newton: Jour. Physiol., 1913, xlvii, 54.

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From a small number of patients — about twenty — in whom exaggerated conditions of cecocolic stasis with the train of general nervous symptoms which go with it and in all of whom constipation amounting to obstipation was present, we have removed 10 inches of the terminal ileum, appendix, cecum, ascending colon, hepatic flexure and a portion of the transverse colon, but not trespassing to a great extent on the part of the transverse colon which contains the omentum. If all of the omentum is removed, as happens in colectomies, in many cases intestinal adhesions of the most severe type subsequently occur, often causing unfortunate sequelae. The cases in which operation was performed were all of an advanced grade and in all there were bands, kinks, adhesions and possibly obstruction, but, if so, of the peculiar silent type with a soft abdomen and without muscular hypertrophy of the intestinal wall.

In the cases in which we have made the above mentioned resection, and joined the end of the ileum to the side of the transverse colon, there has usually been a marked improvement in the general condition of the patients, and in 87 per cent.relief from the constipation. In nearly all these patients the appendix had previously been removed, and in a number of them other operations, such as elevation and fixation of the cecum combined with narrowing of its lumen, etc., had been done without relief. To test the question of the effect of eliminating the ileocecal mechanism and removing the proximal colon in constipation, we have grouped together all the cases in which the head of the colon was removed without regard to the pathologic conditions which lead to the operation, and have investigated the effect the operation has had on the evacuation of the large intestine. It was found that nearly all the patients who had been constipated before the operation have been much relieved postoperatively. Yet in but one case has diarrhea been manifested. It would

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seem a reasonable assumption, therefore, that in physiologic disturbance of the terminal ileum and cecocolon lies the cause in some cases at least of the protean manifestations of intestinal toxemia and constipation, and that the removal of the cecocolon will relieve many of these patients.

Although the operation is a serious one, we have lost no patients operated on for this condition. The number of persons whose condition in our opinion would warrant the risk, however, is comparatively small, and I cannot but deplore the wide-spread adoption by the medical profession of surgical measures for this or allied conditions while it is in the experimental stage with little evidence to show that the supposed cures are permanent. When one looks back over the fads and fancies in medicine, especially as applied to the so-called neurasthenic group of patients, one may well pause and make haste slowly.

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THE REDUNDANT SIGMOID

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THE NORMAL SIGMOID

The sigmoid flexure, more properly called the pelvic colon by the French, the segment of intestine which connects the descending colon with the rectum, is of variable length. In cases in which it was functionally normal or, in other words, in which it was symptomless, I have seen it as short as 15 cm. (6 inches) and I have encountered it as long as 85 cm. (32 inches), while other observers have found it as long as 108 cm. (42 inches). In a series of sixty-two cases of redundant sigmoid of which I have roentgenographic records, I have not so far had occasion to observe a single instance of sigmoid over 25 cm. (10 inches) in length in which it was not the seat of either functional or organic disturbance logically attributable to redundancy. I do not assume that sigmoids of more than 25 cm. (10 inches) in length do not exist in which, for most of the time at least, the function of the intestine is exercised without perturbation. Cases of this kind, however, do not come to me for treatment and I, therefore, have no occasion to observe them. From these facts, I am forced to conclude for the present, that while in the adult, the normal sigmoid is from 15 cm. (6 inches) to 25 cm. (10 inches) in length, the question as to what is and what is not a normal sigmoid relates quite as much to physiology as to anatomy.

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RELATIONS OF THE SIGMOID

The full surgical significance of the colon, or to put it more broadly, its full clinical significance, cannot be comprehended without due consideration of its relations. It is important at least to remember that, in the male, the sigmoid, when redundant, may lie in contact with the left ureter, the left iliac vessels and the left sacral nerves, the bladder, prostate and rectum; while in the female, it may lie in contact not only with these structures, excluding, of course, the prostate, but also with the vessels in the left broad ligament, with the left fallopian tube and ovary, and with the uterus itself. The pelvic lymphatics on the left side may also be subject to pressure by a redundant sigmoid. The degree to which these structures are influenced by the superimposed weight of the redundant sigmoid is, of course, relative to the redundancy itself, to the incidental development of the mesosigmoid and, still more incidentally, to the amount of sigmoidal content.

THE FUNCTION OF THE SIGMOID

It is probably true that, in the normal person, the sigmoid is chiefly a conduit for the less rapid transit of the intestinal content from the colon to the rectum. In other words, in the healthy subject, it is after periodic and more or less rhythmic evacuation generally relatively free from fecal content. At the same time, it must not be forgotten that the sigmoid is provided with an active absorbent apparatus whose ostia connect with the chyliferous apparatus in the mesosigmoid, which in turn connects with the larger chyliferous vessels in the mesocolon. It is furthermore to be remembered that the sigmoid is the habitat of an abundant flora. In addition to this, especially in cases of fecal stasis, are to be found the usual toxins that result from bacterial decomposition. These facts, thus briefly stated, indicate at once the great functional importance of the sigmoid and its potentiality

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as a possible disturber of the peace in the human economy.

SOME PATHOLOGIC STATES OF THE SIGMOID

The disturbances which I shall consider in this connection as being caused by the sigmoid are due to function-disturbing variations from the normal type. Those which I wish more particularly to present to-day are based on observations in cases in which I have operated specifically for conditions within the sigmoid itself, as in the accompanying tabulation.

Redundancy	18	
Neoplasms	5	
Diverticula	2	
Adhesions	4	29
Redundancy and ptosis in connection with similar conditions of the colon	43	14
Total		43

This table represents less than 50 per cent. of the cases that have been referred to me for operation, and in which I have demonstrated a sigmoidal factor, the remainder of the cases having been afforded a *modus vivendi* by other means. It likewise represents less than 20 per cent. of the cases in which I have found redundant sigmoid as the concomitant of redundant and, of course, ptosic colon. In fourteen of these colosigmoidal cases, as shown in the table, I have corrected the condition of the sigmoid. The latter operations have been done in my later practice, and since I have become convinced of the important rôle of the redundant sigmoid as a factor in the causation of disease. At the same time, it represents all the cases, eleven in all, in which I have so far operated for neoplasms, diverticula and adhesions that were essentially restricted to the sigmoid. This, I believe, is in a measure an index to the relative frequency of these conditions. I shall, in the present instance, confine my attention to a discussion of the redundant and ptosic colon.

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REDUNDANT SIGMOID

The sigmoid is here considered redundant in all instances in which it is in excess of 25 cm. (10 inches) in length, and in which it is the seat of symptoms logically referable to redundancy. There are, of course, no data on which one may estimate the frequency of this condition for the simple reason that symptomless subjects do not submit themselves for examination. There are, however, many variations in the morphology of the redundant sigmoid.

A very constant feature is the redundant mesosigmoid which, in both normal and abnormal subjects, is always relatively short above at the juncture of the sigmoid with the descending colon, and, below, at its juncture with the rectum. It is always relatively long, sometimes very long, occasionally as much as 25 cm. (10 inches) in the interval between these two points.

THE DIAGNOSIS OF REDUNDANT SIGMOID

The diagnosis of redundant sigmoid is based on a very variable symptomatology. Probably the most constant symptom is constipation, with more or less colicky pains. These colicky pains are more liable to precede than to attend efforts at defecation, although they may be experienced at both times. The constipation is liable to alternate with diarrhea, especially in cases of so-called mucous colitis with a large proportion of mucous content in the stools. There are generally more or less pressure-symptoms in these cases. Pain referable to pressure on the sacral plexus, generally more marked on the left side, but often present on both sides, is generally present. Cystic irritation, generally without mucus in the urine, is rather a frequent complaint. In men, there is often discomfort distinctly referable to the prostate and obviously resulting from pressure on that gland. In women, there is generally marked tenderness in the ovarian regions, especially on the left side. This may

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be due to pressure not only on the ovary itself, but also on the vessels and nerves within the broad ligament.

Pain at the more fixed points of the colon, namely, the hepatic and splenic flexures, is frequently present, because of the frequency with which the redundant and ptosic colon is a concomitant of the redundant and ptosic sigmoid. Pain just under the margins of the ribs in the left upper quadrant is especially significant of angulation and consequent retardation at the splenic flexure.

In many of these cases, hemorrhoids, due both to pressure and to straining at stool, exist as a distinct complication. One important fact that I have observed as a very constant feature in the several hundred cases that I have examined is that pain referable to the redundant and overloaded sigmoid is generally relieved when the sigmoid is emptied, and that it remains relieved as long as it remains empty.

Physical examination generally reveals dulness in the left lower quadrant. This is sometimes associated with fulness which, in extreme cases, is suggestive of a new growth. There is very liable to be an abnormal increase of resonance over the colonic areas which, it should be remembered in these cases, owing to generally equally redundant colon, are to be found entirely in the lower zone of the abdomen. Female patients should be examined in the erect posture, by digital exploration of the vagina, when pressure, sometimes with a mass, may be detected above the pelvic diaphragm. I have found examination by the proctoscope and sigmoidoscope not only annoying to the patient, but also of negative value as means of diagnosis in these cases.

ROENTGEN EXAMINATION FOR REDUNDANT COLON

The conclusive method of examination is, of course, by the Roentgen ray. It is important in this connection to state that these pictures should always be made

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by an expert, and that to give an adequate conception of the case, certain cardinal rules should be observed namely: (1) The large bowel, clear to the cecum, should be emptied; (2) the barium solution should be used in quantity sufficient to fill the large bowel clear to the cecum; (3) pictures should be made with the patient in the erect, the recumbent and the extreme Trendelenburg posture; (4) the patient should then be given not less than 8 ounces of the barium solution by mouth; (5) pictures of the stomach should then be taken with patient in various positions; (6) pictures, especially with the patient in the Trendelenburg position, should then be taken beginning about fifteen hours after ingestion of the solution, and at shorter intervals thereafter, until all the barium has passed into the rectum; (7) time observations of stomach clearance and of food transit are best made after incorporating barium with an ordinary meal.

These rules, adopted by Dr. Sidney Lange, who has made practically all of my Roentgen-ray examinations, have yielded results which in no instance have failed of confirmation at the subsequent operation.

LOCAL SEQUELAE OF REDUNDANT SIGMOID

Local sequelae of the redundant and ptosic sigmoid are various and may be classified as (1) those that relate to the sigmoid itself, and (2) those that relate to adjacent organs and structures.

1. Among those that relate to the sigmoid itself is inflammation. In practically all of my cases, there has been a history of sigmoiditis sometimes present at the time of examination, but more generally with a history of previous attacks, characterized by mucous diarrhea. This is due not only to mechanical interference with the blood circulation, but especially to mechanical retardation of the fecal current with a consequent elaboration of the toxins of bacterial origin. In certain instances, the follicular infection

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becomes so pronounced that the endothelium is broken down, granulation tissue is thrown out and more or less distinct areas of ulceration are developed. Secondary to these changes and as a necessary incident to their recovery, is the formation of bands of scar tissue which, in turn, become sources of irritation. These changes are most liable to occur at the juncture of the sigmoid with the rectum. The fact that it is precisely at this point that cancer is most liable to occur, and the well-known relation of this disease to persistent irritation, certainly comprise a substantial reason why the underlying causative condition should not be allowed to continue. It should be remembered, too, that when the endothelium is once broken down, atria are thereby formed for the convenient introduction of other infections.

2. Among the intrapelvic disturbances induced in adjacent organs and structures by the redundant sigmoid are chiefly those which may be attributable to pressure. I have already called the attention of this Section to the influence of this pressure in causing uterine displacements and functional disorders of the ovaries characterized by pain, especially at the menstrual period.[1] I have already referred in this paper to the effect of this pressure in inducing irritation of the bladder in both sexes and of the prostate in the male. The influence of this condition in causing hemorrhoids and their sequelae is so generally recognized and is so manifest that its further discussion is not required in this connection.

SYSTEMIC SEQUELAE OF REDUNDANT SIGMOID

It is, however, with the remote or systemic consequences of the redundant sigmoid that the general practitioner has his most baffling contention. These induced systemic states, so far as they relate to the

1. Reed, Charles A. L.: Constipation and Headache in Women, THE JOURNAL A. M. A., Aug. 3, 1912, p. 354.

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sigmoid, are less confusing if they are recognized as being most generally equally attributable to colonic origin. In other words, redundancy and consequent ptosis of the sigmoid and the colon occur so generally together that both must be taken into account in the estimation of their systemic consequences. I am, however, to-day emphasizing the sigmoid end of the proposition only because it represents the etiologic factor now most generally overlooked by both the general practitioner and the surgeon.

It may, therefore, be said at the outset that the remote or systemic results of redundant colon are effected through two distinct avenues of influence: first, the circulations; and second, the nervous system. It is obvious, from what has already been said, that toxins elaborated from the abundant bacteria, as the result of fecal stasis, first reach the system through the ordinary channels of absorption. A little later, when the endothelium is broken down, these toxins and other infectious elements may find a short cut into the blood-current. In these ways, one or both, the blood becomes the effective final carrier and distributor of agencies that deleteriously influence not only metabolism, but specifically the processes of hematogenesis.

While this is going on, we have to reckon with the element of pain. It takes violent muscular effort on the part of the large bowel to force hardened fecal masses around sharp corners. This means pain, sharp colicky pain, and persistent pain means unhappiness while it lasts, and more or less exhaustion of the centers when it is over. The pressure exerted on other organs, such as the ovaries, the fallopian tubes, the bladder, the prostate, the rectum, causes pain, and this pain, too, is registered on centers already hypersensitized by toxic agents carried to them by the blood.

Then, following in the wake of this unhappy state, are other changes of more serious significance. With

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the infection thus reaching the circulatory current, we have established what is now recognized as the underlying pathology of rheumatism, gout, arthritis and arteriosclerosis—a relationship that was pointed out by Glénard thirty years ago under the general term of "arthritism." We trace the process a little farther and find these toxins, together with toxic products of metabolism, carried to the great emunctories for elimination. These organs, in turn, become the seat of infection and of secondary changes, such as are manifested in chronic interstitial nephritis and in chronic interstitial hepatitis with their end histories of cirrhosis—a process likewise recognized by Glénard and designated by him under the general term of "hepatism." In other words, a survey of the systemic conseqences of the infection, or the subinfection, or the intoxication originating in the large intestine, forces on us what the late lamented Forchheimer designated as "a new viewpoint in medicine."

SECONDARY SYSTEMIC SEQUELAE

There are certain conditions which do not comprise distinct links in the chain of events as defined by Glénard, which are materially influenced, if not determined, by colosigmoidal redundancies and consequent stasis. They are, for the most part, conditions resulting from entirely independent causes, generally infectious, which are obviously logically and inevitably influenced for the worse by the toxemias and the nerve perturbations incident to the conditions just enumerated. Let me make a few illustrative citations:

An eminent lawyer, after three years' confinement in a sanatorium for simple melancholia, was referred to me by Dr. Herman H. Hoppe of Cincinnati; restoration of the sigmoid and colon by my fixation methods resulted in his return to a large practice within two months after operation.

A merchant referred to me by Dr. J. W. Hall of Chicago had been a neurasthenic for years, was mentally depressed and had interstitial nephritis (a link in the Glénard chain); an

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ileosigmoidostomy resulted in his complete restoration to health, including disappearance of his kidney complication, and in a realization of efficiency beyond his original standard.

A physician had been compelled to abandon his practice because of persistent pain, including a chronic prostatitis; an anastomotic operation, excluding both the colon and the upper loops of the redundant sigmoid, resulted in a cure of the prostate, the disappearance of all neuropsychic phenomena and the resumption of a large practice.

A young woman who had been for a time in the Ohio Tuberculosis Hospital at Mount Vernon, was referred to me by Dr. ——— of Loveland; a fixation operation resulted in the complete restoration of her nutrition and the ability to throw off any remaining tuberculous infection.

Cases of diabetes mellitus have shown marked improvement following restoration of normal conditions within the large bowel. Rheumatism bears such a demonstrable relationship to infections of intestinal origin, that cardiac complications of rheumatic origin must be reckoned among the remote sequelae of such infection.

The situation may be summarized by the statement that any systemic or even local disease that is deleteriously influenced by impaired nutrition must necessarily have an important sequent relationship to coexisting redundancy of the sigmoid and colon. In other words, this condition of the elementary back must take its position among the local infections and must be treated accordingly.

TREATMENT OF REDUNDANT SIGMOID

The question of treatment is to be solved only in recognition of the demonstrated pathology of redundancy and ptosis and in the light of the clinical conditions presented in each individual case. Thus, if the obstipation is not difficult to overcome, or at least to mitigate, certain lines of palliative treatment may be adopted with temporary advantage, but, of course, with no hope or prospect of ultimate cure. If, on the other hand, the obstipation is persistent and, especially, if either local or systemic sequelae, or both,

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Fig. 1.—In this and the following roentgenograms are illustrated some types of sigmoid as shown by the Roentgen ray. In this illustration is shown a redundant sigmoid which drops above the umbilicus when the patient's shoulders are lowered (Trendelenburg position).

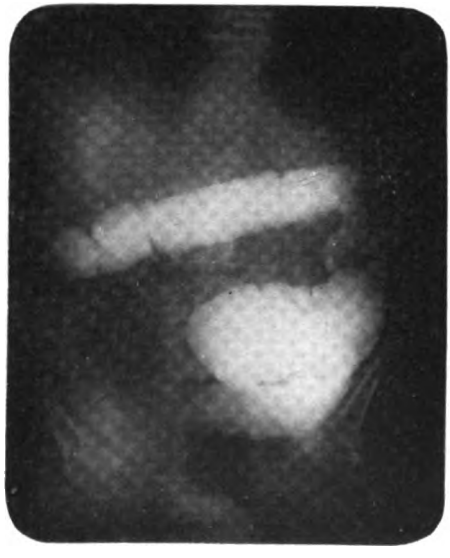

Fig. 2.—(Trendelenburg position) showing large sigmoidal loop which drops heavily on the pelvic organs when the patient is in the upright posture.

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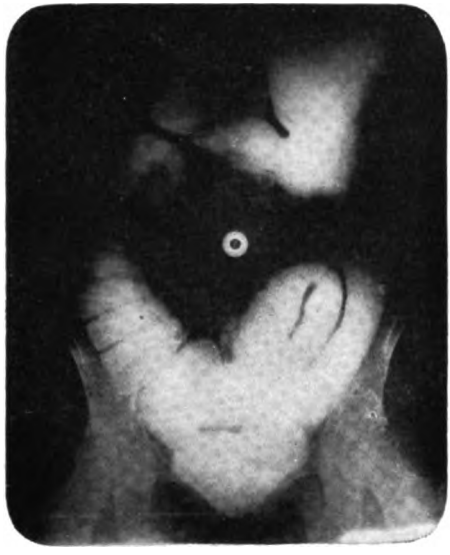

Fig. 3.—A very large sigmoidal loop associated with cecum mobile and ptosic colon (erect posture).

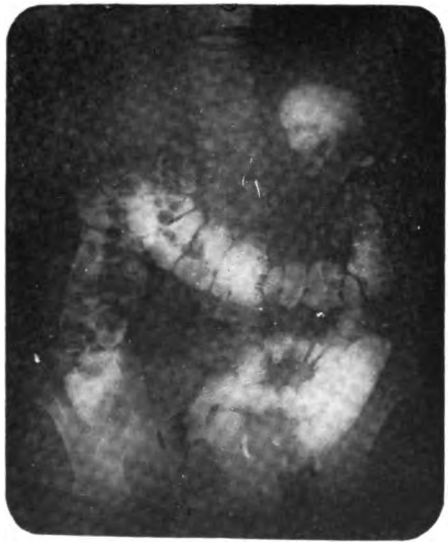

Fig. 4.—Figure-of-eight sigmoid (Trendelenburg position).

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Fig. 5.—A redundant letter S sigmoid which was the source of pressure on the prostate (recumbent posture).

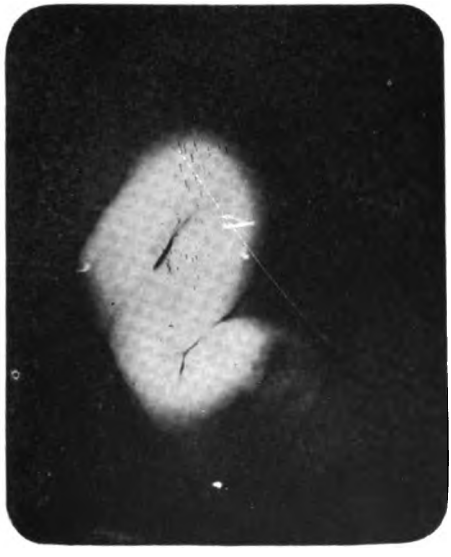

Fig. 6.—An enormous sigmoidal redundancy with hypertrophy but without corresponding condition in the colon (upright position).

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Fig. 7.—Sigmoidal loop with ptosic colon but with stomach in relatively normal position (Trendelenburg position).

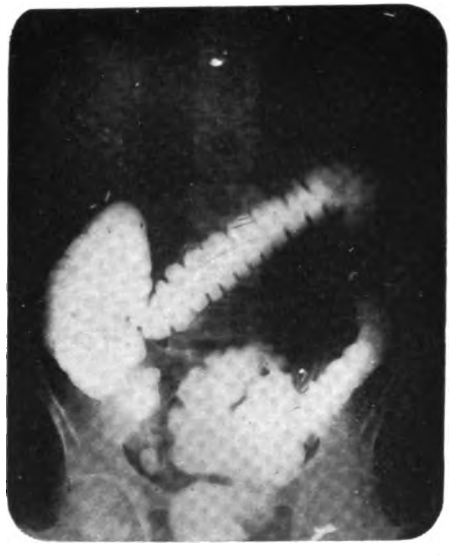

Fig. 8.—Figure-of-eight sigmoid (redundant) complicated with acute angulation of the colon at the hepatic flexure (recumbent position).

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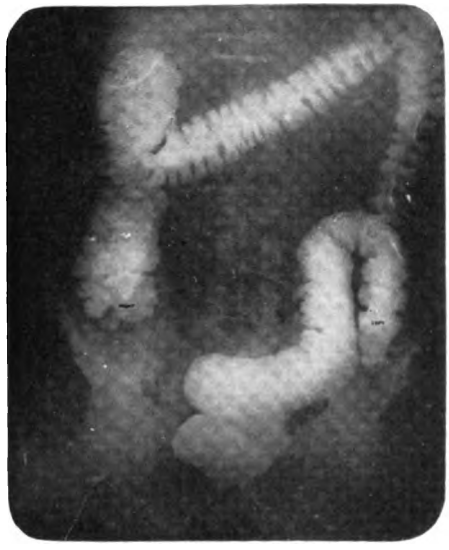

Fig. 9.—Enormous sigmoid loop which was the cause of ovarian dysmenorrhea and other intrapelvic symptoms of pressure (Trendelenburg position).

Fig. 10.—Greatly redundant sigmoid lying chiefly in right side of pelvis (Trendelenburg position).

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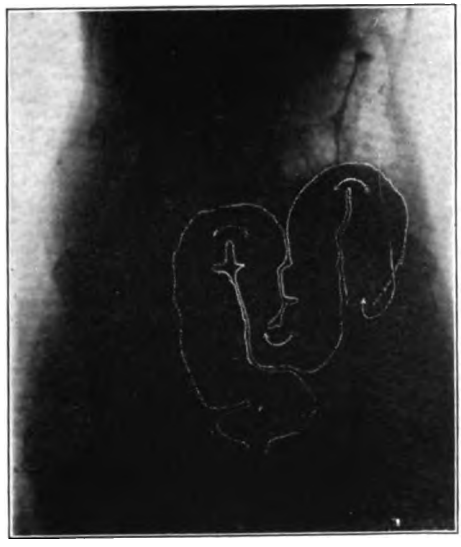

Fig. 11.—Largely redundant sigmoid adherent to anterior abdominal wall (recumbent posture).

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have developed, nothing short of surgical intervention can bring the slightest hope of permanent relief. This brings us to the contemplation of (1) palliative and (2) curative treatment.

1. Palliative treatment may be relied on, in a certain limited number of cases, to afford a *modus vivendi* without, however, offering any prospect of eliminating the underlying or causative condition. In many cases I have been able to make patients very comfortable for a considerable length of time, and without operation by a course somewhat as follows:

Postural Treatment with Massage.—The patient is taught to utilize the Trendelenburg posture. This is done by means of an extemporized inclined plane, ordinarily an ironing-board, one end of which is placed on the side of the bed and other end on the floor. The patient lies on this, heels up and head down, the board coming to the nape of the neck. While in this position, which is maintained for a period of from ten to fifteen minutes, two or three times a day, the patient herself massages her abdomen by drawing the viscera toward the diaphragm. It would seem that the downward displacement of certain abdominal organs is a penalty that we pay for assuming the upright posture and that to stand on our heads, or as nearly on our heads as possible, is the logical correction. In carrying out this practice, I have discovered that it has another incidental advantage, which is, that by gravity it forces the nutrition of the brain and higher centers. When these centers have been depressed, almost exhausted, by pain, both physical and mental, and by toxins transported from the intestines to the brain through the circulation, the condition that they present is essentially that of anemia. This condition is best relieved by having the blood forced into the brain in maximum quantity compatible with health—a principle which may be utilized with advantage in certain neurotic and

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neuropsychic states that may occur quite independently of the visceral complications that I have been discussing.

Dietetic and Medicinal Treatment.—The diet is looked after by giving laxative foods, especially the grits and fruits. The patient is taught to drink copious draughts of very hot water, from a pint to a quart, immediately on arising, if necessary, repeating the libation before each succeeding meal. This is often all that is required to secure free action of the bowels. When, however, it proves inefficient, I add to the water a small quantity of some laxative salt of sodium or magnesium, preferably the former. Vichy water, or the salt made therefrom, may be effectively employed in this way. On general principles, however, the less medicine the better. I am employing the petroleum oils with advantage as a mere lubricant of the intestines. Liquid petrolatum, petrolatum, oil of petroleum and paraffin oil are products belonging to this class, and of about equal efficiency.

Mechanical Treatment.—While the postural treatment—including hydropathic—already mentioned may be considered mechanical, I am using the term in a restrictive sense as applied to external appliances, such as belts and braces. It is obvious, from a moment's glance at the anatomy involved, that no such appliance can be effective in preventing the ptosis of a redundant sigmoid. On the contrary, such an attempt to hold up this segment of the bowel can only result in pushing it farther down in the pelvis. So true is this that, for the relief of such cases, it is important that even the incidental pressure of clothing suspended about the waist should be interdicted. Another phase of mechanical relief is that by enemas, by which the fecal content is softened, the weight of the redundant bowel lessened, and the consequent pressure diminished.

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2. Contrasted with palliative treatment is curative treatment. While such expedients as posture, massage, diet, medicine and lavage may, in certain cases and for a time, bring a measure of relief, it is obvious that neither all nor any of them can in the least remove the underlying redundancy and the consequent ptosis. In other words, they are mere temporary expedients, the tendency of which is indeed to lower the functional efficiency of the bowel and thus ultimately to aggravate the original ill health of the patient. It is obvious that nothing but surgical intervention can be recognized as having curative significance. But, before considering these measures in detail, it is important again to remember what I have tried to keep constantly to the forefront in this essay, namely, that this condition of the sigmoid is generally associated with a corresponding condition of the colon and that to relieve one without relieving the other is to fail in affording ultimate relief to the patient. With this understanding and addressing myself now exclusively to the sigmoidal state, let me say that the surgical expedients which I have found effective are (*a*) sigmoidopexy, (*b*) ileosigmoidostomy, (*c*) cecosigmoidostomy, and (*d*) resection of the sigmoid, to which may be added, as a measure supplementary to the second procedure, (*e*) colectomy.

It is unnecessary here to give text-book descriptions of these respective procedures. A few incidental observations may, however, be helpful in leading to a selection of the measure to be employed. This, in all instances, should be based on the actual condition as revealed by exploratory incision, and should not be predicated entirely on Roentgen-ray findings. The roentgenogram reveals much that is important, but it does not reveal many conditions that are of determining value in the selection of the surgical measure to be employed. With respect to sigmoidopexy, much has been said in a more or less academic way about

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its "potential dangers." I have no doubt but that some embarrassing consequences have been experienced from this operation by some operators, but I am equally as sure that such consequences have been the outcome of defective methods employed. Indeed, I have done some secondary operations for the relief of patients who had been victimized by precisely such defective methods. In one case, a little 2-inch incision had been made through a thick wall, and the sigmoid had been drawn over to the median line and there firmly sutured in such wise as to give it a permanent acute angle. In another case, the fixation had not only caused similar angulation, but had failed to control the kinking due to redundancy. The resulting complications, for which I was not responsible, were obviously due to defective methods, as shown by the fact that these cases were completely relieved when the fixation was properly effected. In this connection, it is important to say that it is a defect of method to stitch the sigmoid itself, or any part of it, to the abdominal wall, but that the unkinking should be effected by stitching not the bowel itself, but the redundant mesosigmoid to the parietal peritoneum. This is better done by employing the Pfannenstiel, or transverse abdominal incision. If carefully done by this method and if the colon, when involved, has been brought under similarly effective control, and if other impediments to fecal circulation do not exist, the results are eminently satisfactory.

I would not, however, leave the impression that I look on fixation procedures as the ones always to be employed, or even as the operations of choice. On the other hand, in all cases in which correction cannot obviously be thus effected, resection of the sigmoid with lateral anastomosis of the ends, or ileosigmoidostomy, or cecosigmoidostomy with or without resection or removal of the large bowel may well be employed.

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ABSTRACT OF DISCUSSION

ON PAPERS OF DRS. EASTMAN, BONIFIELD, MAYO AND REED

DR. M. L. HARRIS, Chicago: The wide-spread study of diseases of the intestinal tract which has taken place recently has led to the recognition of a number of very important facts which are so prominent that they should be crystallized in our minds at this time. The first of these is that while the intestinal tract during its embryologic and postnatal evolution follows a normal type, yet there is no fixed end stage of this evolution. During the evolution a number of membranes are formed which are but temporary and which as a rule disappear, yet many of these are found to persist after birth. These should not be called pathologic in the sense that they give rise to disturbed function, because they do not, unless they directly cause mechanical obstruction. The next fact is that when we have a disturbance in function due to the presence of these bands of membrane which are found congenitally or to those developing subsequently, the changes are invariably due to changes in the intestinal contents, chemical in nature, bacteriologic or dietetic and metabolic in origin. These conditions arising within the intestines cause the changes in the membranes and bands which then produce the symptoms noted. That gravity plays little or no part in the movement of the intestinal contents or in the emptying of the stomach or colon we discovered long ago in our operations on the stomach. The emptying of these parts is purely physiologic and not a physical process. Any surgical operation done on these patients must be directed to some definite and specific condition mechanical in its nature if any benefit is to be derived from that surgical operation *per se*, and after the mechanical condition has been corrected by proper surgical procedure that patient becomes a medical case and must be followed up by medical treatment, dietetic and other means to change the chemical nature of the intestinal contents, whether of bacterial or metabolic origin. If these cases are not so followed up we may expect relapse with redevelopment of these so-called membranes. The next fact is that while there may be certain physical differences in location and conformation of the intestinal tract, it is a physiologic entity; the entire tract is under a governing and regulating mechanism, and the disturbance of one part must cause disturbance in another. It is useless to disregard the intestinal tract as a physiologic entity in these cases.

DR. JOSEPH SAILER, Philadelphia: As an internist my opportunity to study cases of derangement of the large intestines as a rule antedates that of the surgeon. These cases come to the internist in all stages of the disease. If he has wit enough to discover where the trouble is located

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and persuasion enough to induce the patient to submit to surgical interference he has fulfilled his entire function until, as sometimes happens, at a later date the patient returns for relief from the old symptoms or new ones which may have developed. I urge a greater cooperation between the medical man and the surgeon. I believe it will be generally conceded that abdominal conditions, above all, are the most difficult correctly to diagnose, and, moreover, that in no class of surgery is the importance of preliminary diagnosis greater. Yet it has been my fate on various occasions to have the surgeon respond to what he probably considered my more or less impertinent attempt to explain my conception of the morbid condition, by the statement that he would see what he found after the abdomen had been opened. The best results will be obtained, however, not when the surgeon accepts the medical man's diagnosis but when he is sufficiently familiar with diagnosis to discuss his cases intelligently with his colleague. Three important conditions are: The importance of considering the possibility of some disturbance in the cecum in all cases of supposed chronic appendicitis. Among these disturbances cecum mobile is not an exceedingly rare condition. In many cases removal of a so-called chronically diseased appendix has failed to relieve the symptoms from which the patients suffer. In one such case, anchoring the cecum secured a restoration to health. 2. Those cases in which there is partial obstruction of the large bowel. This also is, I believe, more common than is supposed and fairly difficult to diagnose. The problem of treatment is complicated by the fact that the patient is rarely willing to submit to an operation and curiously enough it is often difficult to persuade the surgeon to undertake it. Why I do not know, for the relief that an appropriate operation affords is sometimes extraordinary. 3. So-called gastro-intestinal intoxication. There is, unquestionably, a group of more or less vague symptoms associated with chronic, partial invalidism concerning whose cause we are at present at fault. They have been called gout, neurasthenia, lithemia, gastro-intestinal intoxication, disturbance of the ductless glands, sympatheticotonia and vagotonia and of late years ascribed to early disturbance of the sexual psyche. The variety of etiology indicates that an actual demonstrable cause has not as yet been discovered. Therefore, all surgical measures which have to do with combating these cases are necessarily measures undertaken on the basis of an as yet unproved hypothesis. I am inclined to believe that some of the brilliant results of colectomy or short circuiting are due to relief of colonic stasis based on an anatomic factor and not the elimination of an intestinal toxemia.

Dr. John H. Gibbon, Philadelphia: The question of colonic stasis has not been settled. We do not know what

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causes the conditions we encounter when we operate in these cases. I believe also that we do not know—we may think we know—that the symptoms are the result of the conditions which we find. There are few here who cannot remember that patients who suffered very much as these patients we now describe as suffering from colonic stasis, were relieved by other means. The fixing of floating kidneys cured many; the removal of the appendix cured many; the removal of the coccyx has cured many. Now to pass out of the realm of surgery, there are other means less radical that have cured many; mechanical, mental and religious treatment. I believe, then, that colonic surgery has not yet found its proper place. Mr. Lane has forged ahead into a new field fired with the enthusiasm of a pioneer. He has developed a wonderful technic, but I feel that those who attempt to follow him will sooner or later have to make some apology, because Mr. Lane —and I think no more honest man lives than Mr. Lane—in discussing one of his cases of colectomy in which the patient suffered from obstruction due to adhesions, said "Why, if it were not for the postoperative adhesions and obstruction which these patients develop, this operation would be as simple as circumcision." Now it is not as simple as circumcision, and it is our business to recognize the fact that it is not. We have heard of the wonderful results obtained in properly selected cases; the difficult thing is to select the case that will give the good result. A great many things in surgery are easily done that ought not to be done. We have heard of the good results of ileosigmoidostomy. I wish we might hear of all the ileosigmoidostomies that have been done in America—that we might consider why there have been bad results and failures. Let us be honest; we are trying to get to the bottom of this. Two small boys were looking at the poster of a circus and they saw an elephant standing on his trunk, and one boy said, "Do you believe an elephant can stand on his trunk?" "Yes," said the other boy, "there ain't nothing an 'elphant' can't do." Now, gentlemen, there are very few things that a surgeon can't do in an abdomen, but just as it is disastrous for the elephant to try to stand on his trunk, so I think it is disastrous very often, certainly for the inexperienced, to attempt to do what is possible, but what is plainly not indicated. Now I hope that those of us who undertake colonic surgery, will beforehand, read the papers of Dr. Eastman and Dr. Mayo presented here to-day. Of course, I am speaking from the clinical, not the scientific, point of view. If we follow the paper Dr. Eastman gives us we shall see that the last word has not been written. He has shown us that we can make a big stoma in the cecum and attach the cecum to the rectum and that still the colon will not drain. Then how on earth can this operation result in the wonderful cures that we hear about?

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DR. JOHN B. DEAVER, Philadelphia: I wish to question the etiology, the cause and effect. No doubt some of these cases of so-called intestinal auto-intoxication are prenatal but not all. I believe the majority are due to pathologic conditions, and we surgeons must determine that pathology. I believe that the surgeon's chief mission is to remove pathologic conditions. The oftener I open an abdomen the less familiar I am with the indications for ileosigmoidostomy or colectomy. Doctors frequently ask me how often I do these operations, and I say, rarely. I believe many a person walks the streets with a peritonitis. It does not give sufficient distress to call the doctor. I have many times seen a driver of a cart come into the German Hospital with an appendiceal abscess and ask for something because he had a little pain, but he had been working just the same. If a man can work with an abscess of that kind the same can be said of a man with a mild grade of peritonitis. After organization of the inflammatory exudate is complete we have bands and membranes, but in the majority of these instances I believe there has been a previous inflammation. The Roentgen ray I think more often misleads the surgeon in connection with the intestinal canal, unless the work is done by a most expert man. I do not operate on Roentgen-ray findings alone. They may influence me to open an abdomen, but If I do not find the lesion I close the abdomen. I think on general principles it is a vicious practice to stitch fast organs which are movable, which too often leaves the last state worse than the first. I have the highest regard for Mr. Lane—all of us who know him love him; he has a charming personality and is a master mechanician; but I do not believe all that he teaches, and I am fearful that his teaching has a bad influence on the younger members of the profession. I would raise my voice with others against too much operating under these conditions. Dr. Janeway, one of the master diagnosticians of the world, was asked to discuss the subject. He said, "Gentlemen, I never made a diagnosis of intestinal auto-intoxication in my life."

DR. HUGO O. PANTZER, Indianapolis: I would agree with the statement of Dr. Mayo that we may not expect in the life of one individual to be able to divert the racial course pursued through thousands of years, without having economic disturbances to follow in that individual. Constipation, no doubt, is basic to many of the pericolic adhesions found in these cases. The scientific and convincing work of Dr. Hertzler is in pertinent evidence. There is no more potent factor in producing habitual constipation than the misconstruction, by profession and laity alike, of the edict that the bowels shall move daily, to mean that one bowel movement daily is sufficient. There is not an animal, except man, but defecates regularly with every taking of food and several times more daily. It is the inconvenience of complying

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with this natural demand that has in turn led the human being to formulate the quasi-statutory edict to Nature that she shall move at one set hour daily and no more. Every individual who does not defecate three or more times daily, must in our sense, be regarded as constipated. Once have applied the natural rule to the human family and with one fell stroke you have eliminated the most potent cause of colic stasis! And, also, you have added to each individual life a daily increase of freshness and vigor and endurance, and an increase of years, which will amount to anywhere from 10 to 25 per cent. for each individual. A phase of pericecal pathology commonly not adequately considered is that whenever the appendix is found in retrocecal position there exists not only more or less contraction of the appendix and adjacent ileum, but also a contraction, adhesion and upward displacement of the posterior wall of the cecum. The filling of the cecum under these conditions soon leads to sagging of the entire anterior portion of the cecum. This makes it impossible for the circular muscular fibers to exert themselves normally. The circular muscular fibers which posteriorly are high and fixed, in their anterior portion are often several inches lower, and no longer opposite, and their function is more or less annulled. The fullest release of the postcecal and pericecal adhesions and membranes alone will suffice to give relief here. Commonly such relief is not considered by the average operator. In my estimation, the condition is commonly mistaken for the prolapse of the entire cecum. Where there is one real cecal prolapse of Wilms, there are twenty-five of the anterior wall. None but he who carefully dissects the adhesions and membranes can establish the truth of this observation. This has been my practice for over twenty years, as my case records can establish, and I wish here to state emphatically that I as yet have not found a case in which short-circuiting of the bowel seemed necessary or warrantable.

Dr. Rosalie Slaughter Morton, New York City: It seems to me as a gynecologist that the greatest advance to be made in the next few years will come from a consideration of the pelvic contents in relation to intestinal conditions. Congestion causing dysmenorrhea, which has previously been difficult to treat satisfactorily, has been often due to intestinal stasis and ptosis and to auto-intoxication producing anemia, lowered muscle and nerve tone. Displacements are often caused by pressure of the sigmoid when it has an abnormally long mesentery, and in many cases we find the uterus displaced downward from the constant pressure of the prolapsed cecum or transverse colon. One of the difficulties in diagnosing dysmenorrhea due to congestion is the variability which results from varying conditions of the intestinal contents, and when examined under ether there are no evidences of congestion because the preparation for the anesthetic

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necessitates the giving of a cathartic and enema which thoroughly evacuates the bowel, producing temporarily a condition which is not the usual one of the patient. In some necropsies we look in vain for the cause of baffling symptoms, because in the moment of death the venous capillaries empty and evidence of congestion disappears. Valuable aid in diagnosis results from the use of bismuth by mouth and in enemas and roentgenograms made every day for a week with the patient in a different position, the patient not remaining in the hospital under abnormal conditions but continuing active in her ordinary occupation. The importance of being able to examine the abdomen thoroughly at the time of a gynecologic operation to see whether there are any intestinal adhesions or angulations, led me to devise a simple instrument, a one-piece abdominal speculum. By introducing the blade through the ordinary low 2 inch incision one can survey the entire abdomen. The handle allows room for the abdominal wall and dressings and keeps the assistant's hand out of the way. By lifting the instrument one can easily find the appendix if it is in its normal position, and if not, by gently turning the wall-lifter, it may be located as high as the hepatic flexure which can easily be seen as well as the gall-bladder. By further turning, the transverse colon, stomach, splenic flexure, descending colon, sigmoid and various portions of the ileum may be inspected easily and without handling. Any lesions of the gall-bladder or constricting bands may be corrected under the present anesthesia, ptosis may be noted for correction, by raising the foot of the bed or other postural treatment during convalescence, thus avoiding complications which often have more effect on efficiency than the gynecologic conditions themselves, as the latter may, in many instances, be considered secondary.

Dr. J. W. Long, Greensboro, N. C.: The pathogenesis of this subject as well as the proper management of these cases may be best understood by remembering the embryology of the alimentary canal. At one time during fetal evolution, most of the intestine, the whole alimentary canal, in fact, is in the enlarged umbilical cord outside of the abdominal cavity. When the colon returns to the abdominal cavity the fetal colon is situated in the left side of the abdomen. As the alimentary tract develops the cecal head is projected, as it were, across the celom, beneath the stomach and liver. Now, while this evolution is going on, there is another important process, namely, fusion and absorption of certain layers of peritoneum taking place. Should fusion of the peritoneum in this region of the abdomen occur too early, the cecum is caught as it rests beneath the liver and we have the high cecum and an undescended colon. This explains those rare cases in which the appendix is found in the kidney fossa above and behind the colon. On the

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other hand, should fusion fail to take place in whole or in part, the cecum descends below its normal situation in the iliac fossa and may even be found in the pelvis lying on the bladder. As a result of the failure of fusion to anchor the cecum in its normal location we have cecum mobile, dilated cecum, ptosis, thinned walls, infection, and local coloperitonitis, with the formation of pseudoperitoneal cauls of the colon, or Jackson's membrane, Lane's kinks, and intestinal stasis. In other words embrology helps to explain pathology.

DR. FRANK C. YEOMANS, New York: On Feb. 10, 1911, at the New York Polyclinic Hospital I operated on a woman, aged 48, for constipation due to stricture of the descending colon. I found the sigmoid very large, at least 3 inches in diameter and 24 inches long. I united the cecum to the sigmoid by a broad lateral anastomosis thus deliberately performing a cecosigmoidostomy. The patient has been perfectly well since the operation. I reported this case with two others in the *American Journal of Surgery*, January, 1913, with the conclusion that when practicable, that is, when the cecum and the sigmoid can be approximated without undue tension, cecosigmoidostomy (*a*) is a safe operation, easy of execution; (*b*) establishes drainage of the entire colon, there being no blind ends left for collection of feces, fermentation and intoxication, the *bête noire* of ileosigmoidostomy; (*c*) observes the surgical principle of draining the colon at its most dependent points, a principle correct both in theory and in practice; (*d*) anchors and drains the cecum mobile of Wilms; (*e*) anchors and drains chronic volvulus of the sigmoid or a giant sigmoid; (*f*) cures permanently constipation due to mechanical obstruction (obstipation) at any point in the colon from cecum to apex of sigmoid. In THE JOURNAL A.M.A., March 7, 1914, Dr. Eastman in an article entitled, "An Anatomic and Physiologic Method of Short-Circuiting the Colon" advises that "the caput coli be anastomosed freely to the rectum at the lowest point possible without traction." I presume that he had not looked up the literature or failed to notice my earlier article, published fourteen months before, on "Ceco-Sigmoidostomy; an Operation for Short-Circuiting the Colon." Now Dr. Eastman terms this operation caput coli-rectum anastomosis, but Dr. Reed, correctly I think, calls it cecosigmoidostomy. The rectum proper begins opposite the third sacral vertebra. I have measured carefully the various portions of the colon and observed their respective positions in 100 cadavers to determine the proportion of cases in which anastomosis is feasible. I found that, anatomically, the cecum can very seldom be approximated to the rectum proper, hence, cecorectostomy is not practicable. The cecum and sigmoid can be approximated, however, in over 70 per cent. of cases. Of course, the anastomosis is made at the lowest point possible on the sigmoid without undue traction. I

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wish to draw attention to the fact that caput coli-rectum anastomosis is but an impracticable attempt to do a low cecosigmoidostomy. I described a successful method of performing cecosigmoidostomy one and one-half years ago.

Dr. Robert T. Morris, New York: To think of this subject as a whole we must think at a target. The authors this morning have given us the opportunity. In thinking at a target we must choose a bull's eye fact: the fact that these patients belong to a class which needed to have its ancestry short-circuited by one or two generations. That means that the surgeon is nothing but a therapeutic resource. These cases are medical first, last and all the time, and we are not to think that we are dealing with the class of patients whose trouble is to be ended by the surgeon. The dog through bad habits of his master has arrived at his master's culture. Consequently he has the same stasis, the same arthritides that the rest of us have. We are dealing with about the same diseases in the dog as in man, among those which are frequently colonic in origin. Dr. Eastman spoke of the *Bacillus adhesiformis*. This would mean a bacillus in the shape of an adhesion. There is no such bacillus. In many of these cases we see striking results, from operation sometimes, but it is for the good diagnostician to work out the class of case in which the operation of short-circuiting should be performed. For instance, I had a patient with spasmodic asthma who had not lain down for four years. Whenever the colon was flushed the attacks of asthma were very much lessened. On the basis of this reasoning and the facts elicited in the laboratory, I short-circuited the bowel and the patient has not had any spasmodic asthma since.

Dr. Thomas S. Cullen, Baltimore: In a study of many subperitoneal pedunculated myomata I have been greatly interested in following the behavior of the omentum, in those cases in which it became adherent to the myoma. As the pedicle of the myoma became more attenuated and the blood-supply from the uterus diminished the omentum would gradually make up the deficiency by sending in vessels to the now partially parasitic tumor. The omental fat would gradually disappear until finally the omentum was represented only as a bunch of large vessels which passed from the vicinity of the transverse colon to the tumor. Nearly twenty years ago Dr. Preston, of Hampsted, Md., saw a patient suffering, as he thought, from gall-stones. She went into a state of collapse and he diagnosed rupture of the gall-bladder. The consultant laughed at him and said it could not be so. She recovered, and fifteen years later when I opened the abdomen on account of further gall-bladder symptoms I at once saw six or eight typical gall-stones lying outside the gall-bladder covered by a transparent layer of adhesions. They were as clearly seen as is a glacé nut through the coating of candy. Nature had sealed them over perfectly with-

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out leaving any tags of adhesions adherent to surrounding structures. Dr. Marcy speaks of the increased meat-eating in England and the coincident increase of cancer. I recently asked Dr. Hirst of the Severance Hospital, Korea, what was the most common disease in Korea. He said they had more empyemas than anything else. I said "How about appendicitis?" He said "We have had five cases in ten years." They have a large hospital where Dr. O. R. Avison and he are doing the surgery. Every one of these five cases of appendicitis was in a foreigner, so that appendicitis in Korea is a negligible quantity, and as you know, the Koreans have little or no meat to eat.

Dr. Jerome M. Lynch, New York: I hardly ever attend a meeting of any surgical society that some one or two men do not condemn Mr. Lane. If the rule laid down by Mr. Lane is followed there will not be so much occasion to criticize his method. These cases have been treated by physicians and by surgeons and what is the result? The patients have gone to osteopaths, Christian Scientists and a lot of other quacks. If you would short-circuit these cases you would not have the unsatisfactory results that are reported. Every one of ten patients we have so operated on has gained in weight. In a girl 18 years of age with hemorrhagic colitis, there was a gain of 30 pounds. If you put the patient on a meat diet the stool will be liquid when it reaches the cecum. In over 200 experiments we have demonstrated this. If you give a carbohydrate diet it becomes solid. In a great many cases solid feces come from the ileac opening; often the ileum takes on the function of the colon and the feces are thrown into the colon and cannot be removed by flushing or any other means than short-circuiting.

Dr. Henry O. Marcy, Boston: With reference to the Roentgen ray, several of my friends in Boston made a careful study of a large number of normal subjects and found the situation of the intestines in no two cases alike. In one of the hospitals in Boston the surgeons thought they found a stone in the kidney and asked the very distinguished expert to make the roentgenogram. There, perfectly distinct, was the object, round, well defined and in the location of the kidney believed to be the organ discovered. They operated, but no stone was found. When the expert operator was asked to explain the picture he said, "I thought surely you would know that was the button on his drawers." It depends very largely on "the man behind the gun." I recall a discussion some years ago in the Section on Surgery when a Texan said, "Operations for appendicitis are often resorted to when not required. First give sweet oil in large doses" and the young surgeons in the audience showed their disapproval in a very marked manner. He said in closing one thing that is worth remembering—"it will grease the intestines." Then I told this illustrative story: Patrick had a pain in his right side; the doctor told him

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to go to the hospital and have his appendix removed, and to take a hundred dollars with him, it would cost that. On the way to the hospital he met a friend. "Oh, Pat," said the friend, "them fellows are always wanting to operate; just go to the apothecary and get twenty-five cents worth of castor oil, and I will come in in the morning and see how you are." In the morning, to his friend's inquiry Pat replied, "Jimmie, financially, I am $99.75 ahead, physically I am running behind."

Dr. J. R. Eastman, Indianapolis: I am not the author of the term *Bacillus adhaesiformis* very justly objected to by Dr. Morris. I referred in my paper to a bacillus which I said Dr. Bassler, an associate of Dr. Morris, thus designated. Dr. Yeomans said that for anatomic reasons, it is impossible to anastomose the caput coli and the rectum. That is true under anatomic conditions. We do not operate, however, under normal conditions. The operation is indicated only in severe ptosis and in serious cases of colonic stasis. It requires perhaps a reckless degree of hardihood for me to differ with a man of the experience of Dr. Reed, but I must take issue with him as to one of his statements. I think the internist would grow very excited over his remark that no case of colon stasis of serious character can ever be permanently cured by non-surgical means. In a certain percentage of cases we can by the use of simple means like exercise and the vegetarian diet with petrolatum to anoint and lubricate the intestine, relieve the colitis, and when the colitis is relieved the pericolitis will likely also be relieved and consequently the stasis is overcome. It is not simply a matter of lubricating the intestine but of correcting the colitis which frequently causes ptosis and stasis and pericolonic adhesions of all kinds. It can hardly be said at this time that every serious case of stasis is a case for surgery.

Dr. Charles L. Bonifield, Cincinnati: I cannot agree with Dr. Deaver that the Roentgen ray is of no account. He must have a poor roentgenoscopist. The German language is of no account to one who cannot read it. The roentgenogram can be depended on by the one who can read it, and if a man makes a series taking about four a day it throws much light on these cases of ptosis. It is particularly valuable in showing how rapidly the small intestine, the cecum and the sigmoid flexure empty themselves. As I remarked before there are degrees of this condition. The cases in which I believe we must operate are those in which the disease has progressed until the large intestine has elongated, and in which its convolutions are scarcely discernible. My old teacher used, in constipation, to prescribe full doses of ergot, and I have found that is a very good drug in the early stages of relaxation of the bowel.

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DR. WILLIAM J. MAYO, Rochester, Minn.: Surgery of the colon is still in the stage of case-reporting. We have to go through that period. We must be wary of the promoter in surgery as we are of one who tries to sell an oil well. Promoters are as necessary as a drag behind a wagon to keep it from going too fast; but, we must beware of them, because if we accept their teachings, we are going to overdo things. There is something in the question of the large bowel. It may be too long and too big. If we could only say to certain patients that they have too much bowel and that if they continue to live on a meat diet they will not live as long as on a vegetable diet, because Nature has created them vegetable feeders, we might do good if we were sure it were true. If some one would take up the question of our ability to handle various foods much trouble might be avoided. It has been shown that the ordinary man takes two or three times as much meat as he can efficiently care for. Consequently, putrefaction and stasis may occur in the large bowel. Over 60 per cent. of all water we take is absorbed by the large bowel. The danger to all the human family from their inability to absorb all fluids taken is from the development of acid bacteria. The mouth should be alkaline, but when we have an infection in it, the acid-borne bacteria may be carried down from the mouth, and become, possibly, a factor in gastric ulcer and duodenal ulcer. The question is not one of local development but of bacterial infection, the bacteria of chronic and acute conditions going to the liver through the portal circulation.

DR. C. A. L. REED, Cincinnati: One of the speakers, a Philadelphia man, said that his opportunity to study this question was generally postoperative. Dr. Deaver also of Philadelphia, has informed us that the last state of these cases was generally worse than the first. The cumulative evidence forces me to conclude that gastro-intestinal surgery in and about Philadelphia must be in a very unsatisfactory state. Let me suggest to those men that they may with profit journey to Cincinnati, where they will find a hospital clinic in which such results are not demonstrable, but in which we will show a primary mortality that is practically nil, with an ultimate functional recovery of better than 85 per cent. Dr. Gibbon alluded to the fact that the profession is very much given to fads. I believe, in a sense, this is true. History, however, will show that every distinct advance in surgical progress has come by virtue of the residuum of truth which has come out of a surgical fad. Therefore, we may look forward with confidence to the ultimate results of this surgery, which is to-day more or less developmental, and as Dr. Mayo said, is yet in the case-reporting stage. Dr. Morris has stated that the rôle of the surgeon is a therapeutic one. If, by this expression, he means helpful or ameliorative, I do not know that any other attitude was ever assumed by the surgeon. He has

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stated, however, that the condition of these patients is not ended by what the surgeon does. As a sweeping fact, this is a totally unwarranted statement. These patients, many of them, the majority of them, in my hands more than 85 per cent. of them, recover, stay well, and by the results demonstrate the law of cause and effect between the colonic or sigmoidal states, or other intestinal conditions and the general ill health. I do not care one rap about the minutiae of intermediate pathology, although I do not wish to discourage my laboratory friends in their efforts to find out the whole truth and all of its details, however infiinitesimal and unimportant. I am afraid Dr. Eastman was just a little inattentive to my exact phraseology. I did not state that intestinal stasis was never relieved except by surgical means. On the contrary, I know that I often relieve it without operative means. What I did say was that, in intestinal redundancy and intestinal ptosis, cure was never secured by other than surgical means. I stand distinctly by that assertion. An elongated, redundant colon and a sigmoid in similar condition were never made less by any medical treatment. An elongated, redundant mesosigmoid was never made shorter except by appropriate surgery. It is impossible. I would just as soon attempt to reduce a dislocated elbow with a dose of Epsom salts as try to overcome one of these conditions I have just described by any sort of medicine.

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PARENTERAL PROTEIN DIGESTION

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INTRODUCTION

The units of life in our bodies are the cells of which our organs and tissues are composed. In order that we may be in health, all the cells of our bodies must be in normal condition and must function in harmony. Inasmuch as these cells are living, growing and multiplying, they must have a supply of normal food, and since these cells are made up of protein to a large extent they must be supplied with protein food. The digestive functions of the alimentary canal have been developed for the purpose of preparing proteins for the body-cells to feed on. The proteins of our food are normally broken up in the digestive tract into amino-acids. These are absorbed through the intestinal walls and serve for the nourishment of the body-cells. The blood and lymph carry to all the cells of the body the prepared and absorbed protein split products. Each kind of cell selects from these products such portions as it needs in its own metabolism. It sometimes happens that proteins reach the blood and lymph without being acted on by the digestive juices of the alimentary canal. On a small scale this is constantly happening. We absorb minute quantities of protein through the mucous membrane of the respiratory tract, and in ordinary health it may happen that small amounts of undigested or imperfectly digested proteins are absorbed through the intestinal wall. In the therapeutic employment of serums and vaccines undigested protein, sometimes in large amount, is introduced into

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the circulation. In case of infection, living proteins find their way into the body and there grow and multiply, converting the simple soluble proteins of the body-fluids into complex, foreign proteins. When foreign proteins find their way into the body by any of these methods they must be digested by the agency of ferments supplied by the body-cells. This process we designate as "parenteral digestion" in contradistinction to the normal "enteral digestion" which goes on in the alimentary canal. Up to the present we know but little concerning the action of the parenteral proteolytic ferments or their digestive products. We know that at one stage in enteral digestion the protein molecule yields an active poison, but in normal digestion this is split into harmless bodies before absorption. In parenteral digestion this poison is set free in the blood and tissues and gives rise to the symptoms of the infectious diseases.

How to control and modify parenteral protein digestion is now one of the big problems in experimental medicine.

The body-cells feed on the pabulum brought to them by the blood and lymph. The wandering cells, such as the leukocytes, may go in search of food, and observation has shown that they are attracted to localities in which there is accumulation of protein material, as to the intestinal walls during the process of digestion, to local infections and to points where non-diffusible proteins, living or dead, are injected. But most cells of the animal body are fixed and can act only on pabulum brought to them. The blood and lymph carry in solution both proteins and protein split products, the latter as amino-acids. Of these split products each kind of cell selects such as it may require in its metabolic process. To what extent body-cells are nourished by the amino-acids absorbed as such from the alimentary canal we do not know. Indeed, until recently it was believed that all the amino-acids formed in enteral digestion are synthesized into albumins and globulins

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either during absorption or soon thereafter. That this is the fate of the greater part of these protein split products is certainly true. The diverse proteins of the food are split into amino-acids in the intestine and synthesized into specific proteins, peculiar to the species, and these are distributed through all the tissues by the blood and lymph and constitute the protein food-supply of the cells. Therefore, the bulk of the protein food carried to the various organs is the same and each kind of cell must split this in such a way that the cleavage products can be utilized in its own particular structure. The liver-cell must split the albumins and globulins, one or both, in such a way as to serve its own needs, and the pancreatic cells must obtain from the same raw material, building stones cut to fit its peculiar masonry. The agencies with which this work is accomplished are known as ferments. We do not know the exact nature of any ferment. We can recognize their presence only by their effects. There must be as many kinds of ferments as there are kinds of cells, and each ferment is specific and cleaves the substrate along its own peculiar lines. From this it must follow that the cell peculiar to each organ in the animal body supplies its own specific ferment or ferments and it is by virtue of this that the cell continues to live. This conclusion reached by reasoning has been demonstrated by experiments.

DIGESTION IN UNICELLULAR ORGANISMS

Experimental studies of digestive processes in unicellular and other low organisms have been numerous and the literature thus developed is too voluminous to be reviewed in detail. I will content myself with notice of some of the more important contributions such as enable us to understand cellular digestion in general. Leidy[1] made many observations on digestion in amebas. In the first place he called attention to the fact that amebas feed on algae and that they are most

1. Leidy: Fresh Water Rhizopods of North America.

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numerous where their food-supply is most abundant. He watched the ingestion of the food which is accomplished by two pseudopodia which enclose the infusorian which now lies in the vacuole and gradually loses all structure and ultimately disappears. Large amebas (*A. proteus*) feed on smaller species (*A. verrucosa*). Engulfed algae gradually turn brown while being digested. Kölliker[2] made similar observations and found the average time between ingestion and the extrusion of the indigestible portion to vary from two to six hours. Carter[3] points out that the ingestion, digestion and egestion of food substances distinguish amebas from plant-cells. Haeckel[4] regards the intracellular digestion in rhizopods as a chemical process, but fails to make any satisfactory demonstration of this belief. Greenwood,[5] from his studies of digestion in amebas, comes to the following conclusions: 1. Starch is ingested on contact but is not digested. It may be retained as long as six days, but is then rejected without change. 2. In regard to fat he is left somewhat in doubt. Milk globules are included, but after twenty-four hours they give normal and ready reaction with osmic acid. The ultimate disposal of fat was not satisfactorily determined. 3. Naked proteins (monads) are quickly and thoroughly digested by amebas. 4. Shielded proteins (enclosed by cellulose walls, such as *Torulae*) are slowly digested without break in the cellulose wall. The last point is important. It shows that the ameba elaborates a digestive fluid which penetrates the cellulose wall and digests the contents.

Next come the highly important experiments of le Dantec,[6] which show that in amebas and all infusoria, so far as tested, intracellular digestion is accompanied by the development of acid. The fluid of the vacuole

2. Kölliker: Ztschr. f. wissensch. Zool., 1849.
3. Carter: Ann. Nat. Hist., 1863.
4. Haeckel: Ztschr. f. wissensch. Zool., 1865.
5. Greenwood: Jour. Physiol., vii, 253.
6. Le Dantec: Ann. de l'Inst. Pasteur, 1890, 1891.

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surrounding the captured and ingested food becomes acid. The nature of this acid has not been positively determined, but there is no proof that it is not hydrochloric acid, and the weight of experimental evidence is in favor of its being this mineral acid. It must be understood, however, that as in the gastric juice, the acid is not the sole and effective agent. Any substance ingested by amebas, without regard to its nutritive character, starts the secretion of the acid, but only nutritious substances are digested. It follows, therefore, that we must assume the existence of digestive ferments which are active in acid fluids as is the case with the pepsin of the gastric juice. It should be stated that Krukenberg[7] found that the glycerin extract of the cellular substance of certain unicellular organisms contains a proteolytic ferment which is active only in the presence of acid.

There is no animal from the lowest to the highest, so far as investigation has been made, which does not elaborate one or more proteolytic ferments. The only organisms in which the truth of this assertion might be questioned on *a priori* grounds are parasites, which might be supposed to depend on their hosts for predigested food. Indeed, some of the first studies made on digestive processes in certain intestinal worms failed to detect the presence of specific ferments, but more thorough investigations have shown that intestinal worms elaborate proteolytic ferments which serve their own metabolism and antiproteolytic bodies which protect them against the digestive fluids of their hosts. The universally distributed proteolytic ferments of the animal kingdom are divided into those which are active in acid, and those active in alkaline solutions. The former are generally designated as pepsins and the latter as trypsins.

In unicellular organisms the chief digestive processes are intracellular. Indeed, with many of these low forms of life it has not been possible to demon-

7. Krukenberg: Kuhne's Untersuch., 1882, ii.

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strate extracellular digestion; we are not justified, however, in denying its existence. The yeast-cell secretes a diastatic ferment which rapidly acts on sugar, but its proteolytic ferment is, under normal conditions, retained within the cell in which it functions. Since no known animal can live without protein food and since every species contains its own specific proteins, each living animal must produce proteolytic ferments. As the structure of the animal body becomes complicated and differentiation takes place, certain cells are set apart to do the preliminary digestion for the whole, but each cell must digest its own special food. Therefore, Weinland[8] is right when he states that intracellular digestion occurs in all animals.

DIGESTION IN BACTERIA

It has been generally assumed that bacteria are low forms of plant life, but researches in my own laboratory, confirmed by later studies in Kossel's laboratory, show that bacteria contain no cellulose and are particulate, unshielded proteins and consequently are more nearly related to low forms of animal life. I should not classify bacteria as either plants or animals. In their life processes they are more closely related to animal life. Some bacteria, possibly all, can utilize split proteins in their metabolism, but under ordinary conditions they feed on unbroken, but relatively simple proteins. All bacteria, so far as studied, produce specific proteolytic ferments. In some, only intracellular ferments have been detected; in others only extracellular; in still others both are in evidence. The liquefying bacteria pour out proteases which diffuse widely through the medium and visibly demonstrate their activity. The abundance with which a given bacterium elaborates its protease is subject to many conditions. As a rule, the richer the medium in carbohydrates, the less abundant is the secretion of protease. It is probable that the presence of certain proteins in

8. Weinland: Oppenheimer's Handbuch der Biochemie.

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the medium stimulate the flow of the digestive agent, though, so far as I know, this has not been experimentally demonstrated. From analogy with other living cells, this is the natural assumption. For the most part bacterial proteases act in alkaline solution and, therefore, are classified as trypsins. This, however, is not without exception. Many bacteria which grow in milk and milk products digest proteins in acid mediums.

There are two points about the action of bacterial proteases which I feel justified in emphasizing. One is the fact that their activity is delayed by quinin, antipyrin and other antifebrile medicaments. This may in part at least explain the action of these drugs. The second is the fact that so far as experimental evidence has gone, no bacterial protease is capable of digesting living protein. This seems to me of great importance. The prevailing idea among morphologic pathologists seems to be that the lesions of the infectious diseases are due to the digestive action of the bacterium on the body-cell. The typhoid bacillus is supposed to feed on the walls of the intestine and cause ulceration, and the spirochetes are believed to induce the lesions of tertiary syphilis in like manner. Everything known up to the present time concerning the digestive action of bacteria is contradictory to these views. It seems quite certain that during the period of incubation of an infectious disease, the invading organism supplies the ferment, the simple, soluble non-organized proteins of the body of the host constitute the substrate, the process is largely synthetic and constructive, leading to the conversion of the simple proteins of the host into the more complex, cellular proteins of the invading organism, no marked protein cleavage occurs, no poison is set free and consequently there is no recognizable disturbance in the health of the host. On the other hand, during the active stage of an infectious disease the cells of the host supply the ferment, the complex, cellular proteins of the

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invading organism constitute the substrate, the process is essentially analytic and destructive, and the protein poison is set free and causes the symptoms and lesions of the disease.

It should be stated that the synthetic action of bacterial proteases, such as I have spoken of as occurring in the growth and multiplication of bacteria, whether in the test-tube or in the body, is not an assumption, but a demonstrated fact. The peptone of the culture-medium is built into bacterial cellular protein. Zak[9] has shown that pyocyaneus protease *in vitro* synthesizes simple proteins into more complex ones.

LEUKOCYTIC DIGESTION

The phagocytic theory of Metchnikoff and the work which that distinguished investigator has done in its support are too well known to need statement, and I will confine myself to a brief review of what has been done in the study of leukocytic digestion. Leber[10] showed that sterile pus liquefies gelatin and digests fibrin. Blood-serum plates are now employed in determining the relative digestive action of leukocytes from different sources. A platinum loop carrying a few leukocytes is brought into contact with the plate at several points and the plate is then kept at from 50 to 55 C. (122 to 131 F.) for twenty-four hours. This temperature favors the digestive action of the ferments, and retards or inhibits the growth of bacteria that may be present. Each leukocytic colony digests the serum and forms a lacuna. From the depth of these lacunae the relative digestive activity of each leukocytic colony may be determined. This difference may be demonstrated by comparing the action of leukocytes from myelogenous leukemia with those from lymphatic leukemia. The blood from a case of myelogenous leukemia partially digests itself on being kept for seventy hours at 55 C. This autodigestion and the

9. Zak: Beitr. z. chem. Physiol. u. Pathol., 1912, x, 287.
10. Leber: Die Entstehung der Entzündung, 1891.

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extent to which it occurs may be demonstrated by the presence and amount of albumoses formed as was first shown by Erben.[11] It should be understood, however, that normal leukocytes have a digestive action, as was first demonstrated by Pfeiffer.[12]

The protease of leukocytes may be obtained best from the blood of a case of myelogenous leukemia, by precipitating a properly prepared plasma—leukocyte mixture with alcohol, allowing to stand for some months, and then extracting the precipitate with glycerin. Similar preparations have been made from the spleen, bone-marrow and from sterile abscesses induced by subcutaneous injections of turpentine. The various methods of preparing leukocytic protease are given by Jochmann.[13] It is believed by Jochmann and others that the leukocytic protease is supplied wholly, or at least, most abundantly, from the neutrophil cells. It has been obtained from leukocytes, colostrum corpuscles, the saliva and the lochial secretion. It is supposed to digest excess of milk accumulating in the gland and possibly it may be of service to the child during the first few days of extra-uterine life. That of the lochial discharge may aid in the cleansing of the uterus.

The value of the leukocytic protease in causing resorption from wounds, in cleansing abscesses and in all local infections is well understood. It is well known that tuberculous pus, so long as it is due to an unmixed infection, is quite free from this ferment and it is believed that injections of iodoform in tuberculous, local infections bring to the site polynuclear cells which aid in effecting cure by their secretions. Whenever foreign proteins appear in the body, the leukocytes assemble and endeavor to destroy the undesired material by digesting it. It seems that the ferment is stored up largely in the leukocytes and that the most

11. Erben: Wien. klin. Wchnschr., 1902, p. 276.
12. Pfeiffer: Wien. klin. Wchnschr., 1906, No. 42.
13. Jochmann: Kolle and Wassermann's Handbuch, Ed. 2, ii, 1301.

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effective digestive action does not occur until the leukocytic cells disintegrate. In case of local bacterial infection many bacteria are taken into the leukocytes, and in some instances at least intracellular digestion proceeds much in the same way as it does in amebas. It is held by Müller and others that resolution in pneumonia is the result of the activity of the leukocytic protease, which becomes quickly effective from the dissolution of a large number of leukocytes. According to Bittorf[14] the urine after resolution in pneumonia quickly digests fibrin. Abnormal activity of this protease may be followed by the appearance of the digestive products in the form of albumose in the urine. This is the explanation of peptonuria in cases of chronic suppuration. When a large number of leukocytes disintegrate in a confined space the ferment set free digests any fibrin, lymphocytes and red corpuscles that may be present. The autodigestion of leukocytes leads to the production of ammonia, amino-acids and nuclein bases. Tuberculous pus does not undergo autodigestion. According to Jochmann a spleen, as large as a child's head, from a case of myelogenous leukemia, kept at 55 C., will within twenty hours break down into a dark red fluid in which the connective tissue floats. A normal spleen passes through the same change in about twice the time. The liquefied autolysate contains ammonia, leucin and tyrosin in abundance. The bactericidal action of the leukocytic protease has been studied by Nuttall, Buchner, Schattenfroh, Peterson, Kling, myself and others. One of the important questions is that of the identity of the bactericidal and the proteolytic constituents of blood-serum or of leukocytic extract. There is not time to enter the literature of this subject here.

It must be evident from what has been said that the leukocytes are constantly supplying the blood and bathing the tissues with an active proteolytic ferment.

14. Bittorf: Deutsch. Arch. f. klin. Med., 1913, p. 91.

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Were there no regulation of this process the body would digest itself. There is constantly in the blood an antiferment. The relation between these bodies and its regulation are among the most interesting and important matters in experimental medicine. It seems to be a well-established fact that repeated injections of a ferment into an animal leads to the production of antibody. Such bodies have been produced in this way by injections of pancreatic trypsin, pepsin, rennin and fibrin ferment, and it seems justifiable to suppose that the antiferment or antitrypsin of the blood originates in this way. Indeed, Jochmann and Kantorowicz have increased the antitrypsin of blood-serum to sixty-four times the initial amount by repeated injections of leukocytic trypsin. These investigators believe that the antitrypsin of the blood is identical with pancreatic antitrypsin, and that the former may owe its development to increase in either the leukocytic or the pancreatic trypsin. This means, of course, that the two ferments are identical and their antibodies are. There are many and diverse theories concerning the relation between leukocytic trypsin and its antibody. Laboratory methods of measuring the antitrypsin strength of blood-serum and rules are given for the interpretation of the results. Wiens[15] finds a low antitrypsin content in the blood-serum in all infectious diseases in which the polynuclear corpuscles are increased, and he regards an opposite finding as unfavorable in prognosis. Theoretically he holds that the greater the number of the polynuclear cells, the more abundantly will the trypsin be supplied and the greater the number of bacteria destroyed. Other investigators have reached radically different conclusions that is, they find that those cases do best in which the antitrypsin content is high. It seems to me that a great danger to the life of the infected man lies in the too rapid cleavage of the bacterial proteins, and at one time a rise in the

15. Wiens: Deutsch. Arch. f. klin. Med., 1906, p. 91; Centralbl. f. inn. Med., 1907.

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antitrypsin content may save life. The relation between the leukocytic trypsin and its antibody must be a delicately adjusted one and one which fluctuates from hour to hour. Brieger and Trebing[16] and others have found the antitrypsin titer high in cancer, advanced tuberculosis, diabetes and the severe anemias, and they call it a cachexia reaction. Here again it seems most plausible that the large amount of waste protein material in the blood endangers life in case of its rapid digestion, and the large amount of antibody supplied is a protective agent. Evidently the blood is a digestive, as well as nutritive fluid, and the digestive processes taking place are regulated by a finely adjusted mechanism which at present we do not understand.

There has been for some years increasing evidence that the enzyme-inhibiting constituent of blood-serum is a lipoid. So far as I know the literature, this was first suggested by Schwartz,[17] who found that the inhibiting action of serums could be lessened by extraction with ether and restored by the addition of lecithin. Sugimoto[18] found that the extraction of serums with ether and benzol has the same effect. Jobling and Peterson[19] have apparently settled the question and reached the following conclusions: 1. The ferment-inhibiting action of the serum is due to the presence of compounds of the unsaturated fatty acids. 2. These fatty acid compounds may be removed from the serum by means of chloroform or ether. 3. Soaps prepared by saponifying the chloroform or ether extracts inhibit the action of trypsin. 4. The antienzyme action of the serum can be removed by filtering acid serum through kaolin, and can in part be restored by extracting the kaolin. 5. The decrease in strength of antienzyme in old serums is probably due to the action of serum lipase. 6. Iodin, potassium iodid or hydrogen

16. Brieger and Trebing: Berl. klin. Wchnschr., 1908.
17. Schwartz: Wien. klin. Wchnschr., 1909, xxii, 1151.
18. Sugimoto: Arch. f. exper. Path. u. Pharmakol., 1913, lxxiv, 14.
19. Jobling and Peterson: Jour. Exper. Med., 1914, xix, 459.

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peroxid removes the inhibiting action of the serum. 7. Soaps of the unsaturated fatty acids lose their ferment-inhibiting action when heated with serum at 70 C. (158 F.).

Leukocytes elaborate in addition to the protease, a lipase and an oxidase which we pass by since they are not germane to the subject under discussion.

Jacoby[20] and Richet[21] have shown that the liver-cells elaborate a specific proteolytic ferment, and Abderhalden[22] and his students, by the optical method, have demonstrated that: 1. Infusions of liver tissue digest liver peptone, but not peptone prepared from the kidneys or thyroid. 2. Infusions of thyroid digest thyroid peptone, but not peptones prepared from liver or kidney. 3. Infusions of kidney digest both kidney and liver peptones and to some extent that from the thyroid. 4. Infusions from muscle digest muscle peptone but not peptones prepared from liver or brain. 5. Peptone prepared from testicles is digested by infusions from testicle or from kidney. While more work along this line is highly desirable it seems safe to conclude that each kind of cell in the animal body elaborates one or more specific proteolytic ferments and that the conclusions reached by pure deduction are confirmed by experiment.

It is well established that the products of the cleavage of complex proteins by ferments vary within certain limits. A protease may digest certain proteins and have no effect on others. Some unicellular organisms feed only on certain proteins. The phyloxera feeds only on the grape-vine. Some organisms must pass one or more stages in their development as parasites in certain hosts. Examples of this kind might be multiplied, but it is well known that specific foods are essential to the life and growth of both plants and animals. I take it that this means that only certain pro-

20. Jacoby: Hofmeister's Beitr., 1903, iii, 446.
21. Richet: Compt. rend., Soc. de Biol., 1903, lv, 656.
22. Abderhalden: Ztschr. f. physiol. Chem., 1913, lxxxvii, 220, 231.

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teins can be split along the proper lines to serve in metabolism.

The proteolytic ferments of the alimentary canal of man are capable of digesting diversified proteins, but those furnished by the cells of the blood and tissues are more limited in their action. Parenteral proteolytic ferments are of two kinds, non-specific and specific. The former are normally present in the blood and tissue, especially in the former, of all animals. They differ in kind in different species and in amount and efficiency in individuals. Their function is to break up foreign proteins that find their way into the blood and tissues. They are, within limits, general proteolytic ferments as are those of the alimentary canal; though the variety of proteins on which they can act is more limited. They constitute the most important factor in racial and individual immunity. Man is immune to most bacteria, not because they do not elaborate poisons, for every protein molecule contains its poisonous group, but because they are destroyed by the general proteolytic enzymes as soon as they enter the tissue and before they have time to multiply. Such is the leukoprotease of the polymorphonuclear cells.

It has been shown by work in my laboratory that all proteins, bacterial, vegetable and animal, contain a poisonous group. During enteral digestion this group is, partially at least, set free, as is shown by the poisonous effect of peptone when injected intravenously; but this poison is not readily diffusible and the body is protected by the walls of the alimentary canal and a further step in the process of digestion breaks up the poison into harmless split products. When this poison is set free by parenteral digestion there is no such protection offered.

Jobling and Peterson[23] have shown that blood-serum from which the antitrypsin has been removed or neutralized is poisonous to homologous animals. In this case the blood-serum digests the proteins normal to the

23. Jobling and Peterson: Jour. Exper. Med., 1914, xix, 480.

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animal and the poison thus set free manifests its effects.

Jobling and Bull[24] find that leukoprotease digests typhoid bacilli *in vitro* with the liberation of the poison. They say:

> Freshly washed, unheated typhoid bacilli intravenously injected into dogs cause the development of definite symptoms as early as twenty minutes after the injection. Boiling for ten minutes does not destroy the toxic effects of a freshly washed bacterial emulsion. Complete solution of the bacteria (in dilute alkali) of a fresh emulsion does not prevent the removal of the toxic substance with the coagulable proteins. The action of leukoprotease splits the toxic substance to a noncoagulable state, the digested mixtures being toxic after removing the coagulable portion. The mere presence of the leukocytic ferment is not responsible for the toxicity of the filtrate from the digested mixture, and continued digestion destroys the toxicity of a previous toxic mixture. From these observations it is concluded that the toxic properties of freshly washed typhoid bacteria are not entirely due to toxic bodies that are stored in the bacterial bodies, but that these properties are due largely to products formed by hydration of the bacterial proteins through the agency of ferments present in the circulation of the animal previous to the injection, or which become mobile subsequent to the entrance of the foreign bodies into the blood-stream. Since leukocytic ferments can attack the bacterial proteins *in vitro*, it is possible that the leukocytes are a source of the ferments which are active in experimental and natural cases of intoxication with the whole bacteria.

Thiele and Embledon[25] find protein split products in the blood of animals dying of acute infection and also that the blood-serum of such animals is fatal to healthy ones when injected intravenously. Such observations seem to show quite conclusively that in the infectious diseases the invading organisms are digested, and among the digestive products there is at least one highly active poison.

THE RELATION OF PARENTERAL PROTEIN DIGESTION TO IMMUNITY AND DISEASE

One of the most important facts developed in the study of protein sensitization or so-called anaphylaxis

24. Jobling and Bull: Jour. Exper. Med., 1913, xviii, 453.
25. Thiele and Embledon: Ztschr. f. Immunitätsforsch., 1914.

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is that the nature and activity of cellular ferments may be modified and specific ferments developed. For instance, work in my laboratory[26] has shown that the blood-serum of a fresh guinea-pig has no digestive action *in vitro* on egg-white, while the serum of an animal sensitized to this protein does digest and lead to the liberation of the protein poison. The same is true of animals sensitized to other proteins, bacterial, vegetable and animal, all of which contain the protein poison. This offers a simple and satisfactory explanation of certain forms of immunity both natural and acquired. A man has yellow fever and recovers and is then immune to this disease. During the attack, the body-cells become sensitized and elaborate a specific ferment which destroys the virus of the disease. When subsequently the man is bitten by an infected mosquito the specific ferment destructive to this virus is promptly active, the virus is destroyed before it can multiply sufficiently to disturb health and the man is immune. The virus of vaccine, an attenuated form of the small-pox virus, is inoculated into the body, sensitizes the cells and subsequently there is for a time at least immunity to this disease. A similar explanation suffices for vaccination for typhoid fever and other diseases for which effective vaccines have been discovered.

The study of protein sensitization has done much to improve our understanding of the phenomena of infection. The pathogenicity of a given virus is determined largely by two conditions. First, the virus must be able by means of its enzymes to feed on the proteins of the animal's body. This condition determines whether or not the virus may be pathogenic to a given species. Even close kinship may exist between two species and a given virus be pathogenic to one and harmless to the other. Thus, the ordinary sheep is susceptible to the anthrax bacillus, while the Algerian

26. Vaughan, Vaughan Jr. and Wright: Ztschr. f. Immunitätsforsch., 1912, ix, 673.

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variety is not. Second, the secretion of the body-cells must not immediately digest and destroy the invading organism. The small-pox virus is pathogenic to the man unprotected by vaccination or by a previous attack of the disease. To the protected man this virus is non-pathogenic because the enzymes supplied by the body-cells destroy it.

When a virus is able to feed on the proteins of the host, and the latter is not protected from the former by efficient destructive agencies, the virus multiplies within its host, converting the proteins of the latter into those of its own structure, and this continues until the body-cells becoming sensitized elaborate ferments which digest and destroy the foreign protein. This process marks the active stage of the disease. When the cleavage action of the enzymes of the body-cells proceeds too rapidly the protein poison is set free in amount sufficient to endanger life. This is a brief and incomplete statement of the relation of cellular digestion to immunity and disease.

We are only on the threshold of these studies. What further investigations may develop no one can predict. Undoubtedly theories will be modified by the further elucidation of observed phenomena and those at present held may be radically changed by the discovery of new facts.

I have recently[27] written fully on the phenomena of infection.

27. Vaughan, Victor C.: The Phenomena of Infection, THE JOURNAL A. M. A., Feb. 21, 1914, p. 583; Protein Split Products in Relation to Immunity and Disease, Philadelphia, Lea & Febiger, 1913.

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LIMITATIONS OF THE DIALYSIS METHOD AS A PRACTICAL TEST FOR PREGNANCY

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When Abderhalden first announced that he had discovered a laboratory method of detecting pregnancy based on the fact that a pregnant woman's serum has the power of digesting human placenta *in vitro*, the announcement was received by the medical profession with remarkably little skepticism. One reason for its ready acceptance in good faith was the recognized high standing of Abderhalden and the vast amount of work he had done on protein metabolism. A second and more important reason was that the medical world had already been made familiar with the basic principles involved in the Abderhalden test through the work of numerous investigators during the preceding ten or fifteen years on parenteral digestion, protein sensitization, and anaphylaxis. Theobald Smith's phenomenon, Pfeiffer's phenomenon, the work of Richet and von Pirquet, and the studies of Vaughan on protein split-products, all really anticipated the discovery of serum diagnosis, just as others before Columbus argued that the earth is round. In a recent controversy over the question of priority, Hamburger claims to have published the basic facts of serodiagnosis in 1903. To this Abderhalden replied that Huppert in 1896 published essentially the same line of argument. That the principle of serodiagnosis of pregnancy is theoretically correct is evidenced by its immediate and universal acceptance as reasonable and probable, and

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the wonder grows that someone had not thought of it sooner; for on *a priori* grounds, what is more logical than the inference that the maternal blood-stream, invaded by solid or soluble placental products, will develop ferments which are choriolytic? That the mother's serum does actually contain such ferments, capable of digesting parts of the cooked human placenta *in vitro,* must now be accepted as a fact proved by thousands of tests. As to the absolute specificity of these ferments for placental proteins, there is still some doubt in the minds of a few competent observers like Pearce and Williams, Kämmerer, Flatow, Fried, Plaut, and others. Inasmuch as the last word has not been said on this phase of the subject, the question as to whether the ferments are absolutely specific for placental proteins, must in my opinion, be left open for the present, notwithstanding the protests of Abderhalden and his co-workers to the contrary.

With the exception of Jellinghaus and Losee in New York, Schwarz of St. Louis, McCord of Detroit, and half a dozen others, the number of experimenters in America who have done extensive work on the serodiagnosis of pregnancy is insignificant, while in Germany and Austria the amount of work done along this line has been prodigious. Unfortunately, some reports of work done on the pregnancy test, especially the earlier ones, must be rejected as valueless, because in some instances the wish has been so obviously the father to the thought that the author has proved whatever he set out to prove.

I have been much interested in trying to discover why so many American workers of known ability have abandoned the test after a brief and unsatisfactory experience with it. Is the test really worthless, or is the technic too difficult for the ordinary trained laboratory worker? A majority of experimenters to whom these and similar questions have been put, honestly believe the test is too unreliable to be of any

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practical value. It is my opinion that some of the workers were influenced to lose their enthusiasm for the test by the reflection that, after all, the making of a positive diagnosis of early pregnancy is very seldom of vital importance to the patient, as it might be, for example in carcinoma and syphilis. "Time will tell" now, as it did for our grandfathers in medicine, whether or not the woman is pregnant. This would truly be a lame excuse for indifference on our part to a laboratory proof of pregnancy. Until the laboratory test has established a better claim to our confidence, however, American clinicians, it is maintained, cannot be expected to display much enthusiasm for it, and they will continue to rely on previously known signs and symptoms, in arriving at an early diagnosis of pregnancy.

It would be manifestly improper here to go into details as to the technic of the dialysis test. Those interested are referred to the numerous original communications of Abderhalden himself, or to the excellent descriptions of the technic of the test by Jellinghaus and Losee, and by Schwarz, which are perhaps the best descriptions of the test published in English. There are, however, a few minor points of technic which in my experience are sufficiently important to justify special mention. They are as follows:

1. If the dialyzing thimbles are threaded with a fine stiff bronze aluminum wire, instead of the silk thread usually recommended, they can be handled with much greater facility.

2. Since the dialyzing tubes are not uniform in thickness, it is well to mark the different tubes with indelible ink or pencil in such a way as to indicate their relative permeability to peptones.

3. Sterile cork stoppers for the containers are superior to cotton plugs, as they prevent the evaporation of the chloroform and toluene at incubator temperature.

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4. The principal control should always contain the inactivated serum from the patient's own blood, rather than that from another patient. This point has been strongly emphasized by Abderhalden himself.

5. Boiling alters the permeability of the dialyzing tubes. I have found that "pasteurizing" them in water at about 180 F. for two or three minutes is satisfactory.

6. Whatever the method used in preparing the placenta, the point of great importance is to see that the placenta preparation contains no dialyzable substance reacting to ninhydrin.

7. Finally, the test and control must be treated exactly alike (except, of course, that the latter contains inactivated serum). It is of less importance to use just so much water, placenta, serum, and reagent, than it is to use exactly the same amounts in both test and control. In making the final tests, I always boil both diffusates simultaneously, over the same flame, at the same rate, and for the same length of time.

The importance of this last precaution will be appreciated when we consider that the final test is a relative one, based in some instances on intensity of color, and, therefore, the test and control must be treated exactly alike if the result is to be at all trustworthy.

Bearing in mind the preceding precautions, and also the other points of technic advocated by the author of the test, I have within the past fifteen months carried out the test on ninety-five subjects, about seventy of whom were women known to be pregnant. Nearly all these tests were made by myself in the laboratories of the Marquette University School of Medicine. This is a very small number of tests when compared with the hundreds made at the New York Lying-in Hospital, and some of the continental clinics. My series, however, has at least the advantage of having been begun late enough to enable me to profit by the mis-

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takes of the earlier experimenters, and to avoid all that groping in the dark which made utterly unreliable all the early statistics on the dialyzation test. Without giving a complete tabulation, my results may be briefly summarized so as to bring out the two conspicuous features as follows:

First: The pregnant women of the series practically all gave positive reactions. In fact, the last fifty pregnant women of the series all gave positive reactions except one patient who was about two weeks pregnant (as proved by an abortion about two months later).

Secondly: In this series about 12 per cent. of non-pregnant persons gave positive reactions. These included several patients just operated on for acute or chronic appendicitis, pus-tubes, fibroids, and ovarian cysts.

The positive reactions in non-pregnant patients were at first attributed to errors of technic. Possibly that is the true explanation. But with the most painstaking care I have not been able materially to reduce the percentage of non-pregnant patients giving positive reactions. According to the results obtained in this series, it would appear that the test is of value in a negative sense only. That is to say, if a woman does not give a positive reaction to the test, it is safe to conclude that she is not pregnant. On the other hand if she gives a positive reaction, we can only say that she is probably pregnant. This limitation largely neutralizes the value of the test as it is now carried out.

Some of the contributory causes which in my opinion have limited the popularity and usefulness of the serum test for pregnancy are the following:

1. Although the test appears on paper to be comparatively simple, its proper execution is exceedingly difficult and time-consuming.

2. The test is not well suited for the general clinical laboratory, but should be made only by one who

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is doing the test every day, and always has the materials fresh and in perfect condition.

3. The presence in the blood of filterable substances reacting to ninhydrin has been noted by many observers and writers as occurring during the height of digestion, or in certain conditions of altered metabolism. These substances have been referred to as sources of possible error in the dialysis test for pregnancy. This fallacy can largely be eliminated by using for the control the inactivated serum from the patient who is being tested.

4. The presence in normal blood of non-specific proteolytic enzymes possessing feeble powers of digesting proteids parenterally is, I believe, generally conceded. It seems reasonable that these normally present enzymes might, under certain conditions other than pregnancy, cause sufficient digestion of placental albumin to vitiate the test, or at least make the result doubtful.

5. To procure for the test a sufficient quantity of serum entirely devoid of any trace of hemolysis is sometimes a matter of extreme difficulty, especially in those cases in which the blood must be transported for any considerable distance to the laboratory.

6. The use of parchment tubes or thimbles as filters, constitutes one of the intrinsically weak spots in the dialysis test. No matter how well they are made or how positively the manufacturer may guarantee them, we know that the parchment tubes are an unstable and inconstant quantity, and may be a source of well-nigh unavoidable error. Even after the tubes have been thoroughly tested and the imperfect ones thrown out, we have found that their permeability to peptones and amino-acids becomes altered by boiling, which is the only method of sterilizing them perfectly. We hold that no method of carrying out a biologic test can be an ideal one so long as it depends for its results on the integrity and constancy of a frequently

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boiled parchment membrane. Errors from this source need not be numerous, but the fact that they will occur now and then stands as an indictment against the absolute accuracy of the dialysis method.

A year ago I made the prediction before this section that in the course of time the Abderhalden test for pregnancy would take its place with the Widal and Wassermann tests in point of reliability. Further personal experience with the test and an observation of the experiences of other workers have convinced me that that time has not yet arrived.

SUMMARY

The dialysis test for pregnancy in its present stage of development is of value chiefly in a negative sense only; that is, if a woman fails to give a positive reaction, she is not pregnant. If, on the other hand, she gives a positive reaction, we can only say she is probably pregnant; for with our present technic, from 10 to 15 per cent. of non-pregnant persons will give positive reactions.

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VALUE OF ABDERHALDEN'S BIOLOGIC REACTIONS TO THE OBSTETRICIAN AND GYNECOLOGIST

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At the present state of the investigation it is possible with the aid of Abderhalden's dialyzation reaction and with his optic method to demonstrate the strict specificity of the so-called protective ferments, demonstrating thereby at the same time that the protoplasms of the various organs and tissues of the animal organism differ sufficiently from each other in chemical structure to be recognizable with the aid of these ferments, even after they have been boiled or after they have been reduced to the peptone stage. It is possible to prepare placental albumin and placental peptone which will be readily cleft by pregnancy serum, but which will not be cleft by other serums and certainly not by serum from a cancer patient; on the other hand, it is also possible to prepare coagulated cancer tissue which will be cleft by cancer serum and which will not react with the serum of pregnancy.

Thus, by making a number of cross-examinations, examining the same cancer serum and the same pregnancy serum against the same placental albumin and the same cancer albumin in the same experiment, and finding under these conditions that cancer serum reacts with cancer tissue only, and that pregnancy serum reacts with placental tissue only, one proves the specificity of the protective ferments and the specific structure of the various protoplasms. This demonstration is constantly made in Abderhalden's institution; it has been made in a few other laboratories;

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it has been made time and again in the laboratory of the Department of Obstetrics of Washington University; my associates and I have taken great pleasure in making these demonstrations before the numerous visitors, including experienced laboratory men, who have come to St. Louis for the express purpose of studying certain points of technic.

Obstetricians and gynecologists have a certain advantage in this investigation, which should mean that they also have a certain obligation to assist in demonstrating the truth of this new doctrine. In the women's clinic pregnancy cases and cancer cases are always to be found; the material for preparing albumin or peptone can be obtained fresh from the delivery room or from the operating pavilion; the special precautions in obtaining and handling serum can be readily observed; the women's clinic, therefore, must become the training camp for those laboratory men, who wish to engage in research work in this new field.

It is a waste of energy and material to attempt investigation of other conditions and to work with other organs and tissues before the investigator has learned the fundamentals of this work and has tested the efficiency of his technic on the touchstone of the cross-examination of pregnancy and cancer.

Be it remembered that in these two examinations the material for the preparation of albumin or peptone can be obtained in perfectly fresh condition; while, when working with other organs and tissues, we must obtain the material from the necropsy room or else we must substitute animal organs and tissues, which substitution is not as yet justified on the basis of convincing experiments. The fact that we can prove that the protective enzymes found in pregnancy and in cancer are specific, does not mean that we are willing to use these biologic reactions for diagnostic purposes without the greatest reserve.

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The serodiagnosis of pregnancy, even in expert hands, is subject to error on account of unreliable dialyzing thimbles; danger from this source is reduced, but not eliminated, by multiplying tests and controls. The optic method eliminates this source of error. We find, however, that peptone obtainable in the market is not always reliable and have therefore started to prepare our own peptone. It is true that the manufacturing chemist can do this work better and cheaper than we can, but we can start with a blood-free placental preparation, which is so essential a point that we are unwilling to entrust this work to the manufacturer; we also need other peptones which are not offered on the market.

Besides this source of error contained in the dialyzation method, it must be remembered that, even when the test works out correctly, a positive reaction simply means that the case in question harbors placental elements; usually it means that the patient is pregnant. Placental elements, however, are often harbored in the uterus or even in other parts of the body for long periods after delivery; this is especially true in cases of hydatidiform mole, in which the retention of syncytial cells is so apt to lead to the development of chorio-epithelioma.

These tumors, being of placental origin, naturally give a positive reaction with pregnancy serum. We have a case under observation, at present, of a woman who passed a hydatidiform mole over three months ago, who menstruates regularly, who is not pregnant and whose serum continues to react positively with placental preparations. It is for these reasons that we are unwilling to consider a positive reaction of serum with placental preparations a convincing proof of pregnancy, except in connection with the clinical history of the case and in connection with a thorough physical examination. Even with these limitations the serodiagnosis of pregnancy has been of real service

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to us in arriving at a correct diagnosis in a number of perplexing cases.

In the serodiagnosis of cancer we have likewise found various difficulties. The serum in a suspected case may give a negative reaction although the case is one of cancer; this seems to happen when the cancer tissue used in the test is of different histologic structure from the cancer on which the test is made. We also find difficulty in securing cancer material which can be rendered blood-free and which is free from infection; at other times, it is not possible to isolate the cancer tissue from the tissue of the affected organ. So far it has not been possible to prepare the desirable quantity and varieties of malignant albumins; as regards the preparation of cancer-peptones, this has been simply out of the question.

In the course of time we hope to have on hand coagulated preparations made of the various forms of malignant tumors, but until we are thus provided, we must expect to get negative reactions in cases which differ in histologic structure from the cancer material used in the test.

Eventually, it will be possible to test the serum of suspected cases against mixtures of cancer albumin and cancer peptones and, in case of positive reaction, to ascertain the histologic structure of the tumor under investigation by a second series of tests against the component albumins or peptones of these polyvalent mixtures. The serodiagnosis of cancer will be of considerable value in those cases in which it is not possible to obtain material for microscopic examination before a serious operation is undertaken. The following is a case in point:

A woman, aged 68, suffered with pain and swelling in the region of the gall-bladder, and with jaundice; the diagnosis pointed to malignant disease, but a stone in the common duct could not be entirely excluded and an exploratory operation seemed indicated. The

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serodiagnosis made the diagnosis of malignancy positive, for the patient's serum reacted positively with cancer albumin and negatively with placental albumin; there was no need for removing the patient from a comfortable home and from her family; she died several months later of cancer of the liver.

Serodiagnosis of cancer is of still greater value for controlling cases after radical operations and for watching for a return of disease; also for observing the effect of Roentgen-ray treatment and other therapeutic measures on cancer cells.

The difficulty of securing reliable cancer preparations for this control work has induced us to use the material obtained at operations, regardless of its fitness for general investigations. The serum of the patient is obtained on the morning of the operation; the material obtained at the operation is prepared as well as conditions permit; a small portion of it is used immediately against the patient's serum and gives, as a matter of course, a positive reaction; the rest of this preparation is preserved for the patient's individual benefit and will answer for the control of her own case, although usually unfit to be used in tests on other patients.

This work was started only a few months ago; it is too early to estimate its actual value. This much is evident; the serodiagnosis of pregnancy and cancer by these biologic reactions is already of considerable practical value, but, at present, these methods are not suitable for the routine work of commercial laboratories; the attempt to employ them outside of research laboratories, closely connected with a hospital service, must lead to disappointment and tends to retard real progress in this field.

The demand for easier and quicker methods of serodiagnosis has induced Abderhalden to make the attempt to demonstrate the action of proteolytic ferments by the method used by Gruetzner in

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demonstrating the action of pepsin. Gruetzner uses fibrin stained with carmin; when some of the fibrin is digested, the carmin is set free, the solution of pepsin is thereby stained pink. My associate, Dr. Newell, has used carmin-stained placenta according to Abderhalden's directions, placing about 0.25 gm. of this tissue and 2 c.c. of serum in small test-tubes; after approximately eight hours, the tests containing pregnancy serum turned pink, while the control serum was still yellow, later, as all serums turned more or less pink, it seems worth while to continue these attempts. Abderhalden is also experimenting with other stains, and he advises against the use of this method at present, except in the way of experiment.

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ABSTRACT OF DISCUSSION

ON PAPERS OF DRS. VAUGHAN, ECHOLS AND SCHWARZ

Dr. Herman J. Boldt, New York: I am in accord with what Dr. Echols has said concerning his clinical experience and the conclusions at which he has arrived from his studies. I am not in accord, however, with those who wish to entirely obliterate serodiagnosis, the test of Abderhalden for the purpose of making a diagnosis of pregnancy. That is an unjustifiable position to take, both scientifically and with regard to the work done by those who have paid attention to it. Would any one dare to make a diagnosis of any illness by a single symptom, be that objective or subjective? I believe not. I believe that we should therefore class the dialysis method as only an objective symptom in the chain of symptoms for the purpose of establishing a probable diagnosis, and as such I regard it. Three or four months ago I saw in consultation a woman who was supposed to have an intra-uterine pregnancy. When questioned she gave subjectively a typical history of an ectopic gestation, and objectively this was confirmed. We must remember that between uterine abortion and an ectopic gestation or tubal abortion, it is at times difficult to draw a dividing-line in diagnosis. Subjectively the patient showed the condition of an ectopic gestation, I thought there was a hematocele posterior to the uterus. Since she had no symptoms leading me to believe that she must be immediately operated on I thought it best to keep her under observation. Her condition did not change. For two weeks she was kept at the hospital, when I suggested operating. We found a

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soft incarcerated subperitoneal myoma, that she had been pregnant and had aborted. The Abderhalden reaction in that instance proved negative. I thought that here was an instance in which we could make the diagnosis by the dialysis method and that it had failed. It did not fail, because we did have a negative reaction. We know that the Abderhalden test is always negative a few weeks after expulsion of the fetus. Another case was that of a woman brought by a physician to have her uterus removed. The examination showed the presence of a myoma. She had been seen by a number of colleagues. All advised operation without further delay. The menstrual period had been last seen six weeks previously and she had some gastric disturbance; there was a slight lividity about the mucosa of the vagina. I concluded that there was probably a myoma present in connection with early pregnancy. The Abderhalden test gave a positive reaction. The woman was extremely anxious to have offspring. They had been married fifteen years. In connection with the subjective symptoms I believe I had a right to advise her to await conditions. Under these circumstances we have no right to discredit such a scientific sign of diagnosis if we regard it as only one of the conditions in connection with the case.

Dr. Charles S. Bacon, Chicago: The interest in this subject is not only that due to the question of diagnosis, but to the broader question of ferment digestion. Experiments in the University of Illinois comprise work done by the research fellow in this department. Our results conform almost exactly to those obtained by Dr. Echols, and we cannot agree with Dr. Schwarz in finding a specific ferment in these cases. In the number of observations made care is taken to follow Abderhalden's method exactly. The care that we have taken in the control and the amount of material we have used in making observations on other classes of cases make our conclusion worthy of consideration.

Dr. Philip F. Williams, Philadelphia: We have been working with the Abderhalden test for pregnancy at the University of Pennsylvania for the past two years. In our earlier work we confined our efforts to the dialysis method in pregnancy. Every pregnancy serum examined gave a positive reaction, but a number of serums from non-pregnant patients also responded positively. When we used uterine carcinoma tissue as substrate we found a digestion of this tissue as well as of placenta by the pregnancy serums. As the dialysis shells were found to be unfit for use after the preliminary tests in more than 50 per cent. we devised a method of coagulation and filtration. By this we also had an occasional positive reaction in a non-pregnant serum. Our animal experiments consisted in the injection of kidney tissue into dogs and rabbits. After a single injection, fer-

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ments were developed which digested liver tissue as well as kidney tissue; after multiple injections there seemed to be a tendency for a more definite digestion of kidney tissue. The commercial placental peptone was used with pregnancy serums in the polariscopic method. Our poor results may have been due to the peptone, for in but few cases did we obtain a change of more than 0.04 degree. We have tried to measure the amount of amino-acid in a mixture of pregnancy serums and various placental preparations, before and after incubation, using the Van Slyke deaminization apparatus, but have not obtained any definite data at present. In reviewing our work of the past two years we cannot feel that the pregnancy ferments are of a specific nature.

Dr. F. H. Falls, Chicago: In our work with the Abderhalden test in the University of Illinois we followed the technic absolutely as given by him. We found that fully 12 per cent. of normal persons gave a positive reaction, following exactly the same technic used in examining the pregnant patients. That led us to examine the serum of various pathologic conditions and in these also we found many positive reactions. It seemed important to find what pathologic condition would give positive Abderhalden tests. We investigated cases of pneumonia, nephritis, splenomyelogenous leukemia, acute articular rheumatism and other conditions. Many gave positive Abderhalden reactions when exactly the same technic was used as in the pregnancy test with the placenta as a substrate. This will to a certain extent vitiate the reliability of the Abderhalden test. I think the technic is not too difficult for a person to develop and use who has had experience in the serologic work. I might say that, so far as the cancer problem is concerned, it has been my experience that serum from cancer patients will digest placenta as a substrate. This is not true in every case, however, and there seems to be no definite relation between the extent of the cancer and the digestion that the serum will give. Concerning the boiling of the dialysis thimbles as given by Dr. Echols, we found that boiling No. 579 Schlicter thimbles for two minutes did not cause permeability of the thimbles within a reasonable length of time. I used the thimbles for a month or so and tested them repeatedly, and in no case was there the slightest trace of color. After using a set of thimbles for three months they were discarded, not because they let through albumin, but because their equivalent permeability to peptone had been altered. I think it important to run the inactivated serum control. Only so can we judge the reaction. If, as Dr. Echols said, the inactivated serum-control was negative in cases taken at the height of digestion, then it cannot be the amino-acids present in the blood, but ferment activity in the active serum that accounts for positive reactions under these conditions.

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DR. CHARLES GOODMAN, New York: During the latter part of last year it was my privilege to learn in Abderhalden's laboratory the technic of the dialysis test described by him. It was my intention to employ the test in seeking a method of overcoming autolysis in homotransplantation of organs. In a series of transplantations in fourteen dogs we were able to demonstrate the presence of a ferment capable of digesting suprarenal tissue in the presence of a transplant of the thyroid gland. In a series of cases of pregnancy, my assistant, Dr. Berkowitz, and I were able to demonstrate the presence of a specific ferment with a uniform degree of success by the Abderhalden dialysis test. In a series of cases of malignancy we have been able to demonstrate the presence of a specific ferment capable of digesting carcinoma or sarcoma in thirty-one out of thirty-two instances. We always used serum thimbles as a control. A negative result is of more value than a positive reaction. The test is exceedingly delicate, and false and divergent results may be obtained owing to slight errors in technic. The technic is complicated and difficult but not beyond the realm of possibility of being mastered by serious and diligent application. The fundamental rules of the test must be obeyed. We must not condemn the method because it requires careful working. Professor Abderhalden advised me and the other workers, after having made use of the thimble, to cleanse it in running water for thirty minutes and then drop it into boiling water for fifteen seconds and no longer, because if it boils it becomes thick. After the thimbles have been in boiling water for fifteen seconds they are put into a container of sterilized distilled water and toluene and kept for use.

DR. MICHAEL G. WOHL, Philadelphia: We forget that Abderhalden's reaction has its restrictions and we demand too much from it. The apparent simplicity of the test is responsible for the great inaccuracy of the results obtained through not paying strict enough attention to its technic. Among the errors pointed out I wish to emphasize the importance of boiling the dialysate. The reaction is more quantitative than qualitative. A definite amount of protein cleavage products present in the diffusate combine with a definite amount of ninhydrin giving the violet color. Now, if there is less of the protein cleavage products or less ninhydrin, you will either get a faint reaction or none. The unequal boiling, therefore, whereby you obtain in one instance a greater concentration of the diffusate, and in another a lesser, will be responsible for the divergent results. We count one minute from the time bubbles appear in the test-tube. The amount of water added to the beaker outside of the thimbles must always be uniform (20 c.c.). As Dr. Echols said, it is not necessary to pay much attention to the quantity of water added to the outside of the thimbles. I believe

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that this may account for the discouraging results. I hope that soon we may have a uniform color-scale by which each worker may determine the end-results of the reaction. On the specificity of the ferments the future of the reaction depends. From our work with this reaction in nervous diseases in the neuropathologic laboratory of Dr. Weisenburg and in the Samaritan Hospital, I believe that the reaction is organ specific.

In our cases we find that serums of male patients with dementia praecox digest testicular tissue, and serums of female digest ovarian tissue. Is this not sufficient evidence of the specificity of the ferments? True, we may, under certain conditions, get cleavage of placental tissue or of any tissue with serums of non-pregnant patients, when there is a leukocytosis. As is well known, leukocytes contain non-specific proteolytic ferments and, consequently, serums from patients with an inflammatory condition might give a positive reaction when a negative reading was expected. We make a differential blood-count in all such cases. Another possibility of error lies in some hemorrhage, bruise or hematoma whereby through the hemolysis of the red cells a ferment is liberated which might possibly cause cleavage of protein substances. Do not condemn the reaction in an off-hand manner if it has not met your expectations. Realize the qualitative nature of the test. Search for the cause of your wrong reading. Because you get the positive Wassermann in yaws or psoriasis you do not necessarily discard the reaction but govern yourself in accordance with the clinical picture. Why not apply the same rule to the Abderhalden?

Dr. Clarence F. Ball, Rutland, Vt.: I contradict the statement that cancerous and pregnant conditions will interact generally. I have a series of nearly 100 cases in only a very few of which has pregnancy given a cancer reaction or cancer a pregnancy reaction. Some of the cases have come to operation and I have not been able to demonstrate third-degree proliferation of the epithelium; there was a second-degree proliferation, however. My work in all of these cases has been done running four thimbles: one with activated serum, one with the serum and cancer tissue, another with either serum alone or the tissue—whichever I suspected, and the fourth with placental tissue. I use the cancer tissue for the primary test; placental for the secondary fundamental. The question of the validity depends on more than 90 or 900 cases: it depends on work which must be as extensive as that on the Wassermann has been. It may share the same fate as the Wassermann, or even worse. I believe, however, that there is a better future for the test. I have followed Dr. Schwarz' modification of the Abderhalden test, although I have not been to Dr. Schwarz' clinic. As to the question of cancer fundaments, obtain all your cancer tissue with as many cells as you can obtain free from

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the tissue invaded. The tissue that I have had the best results with has been that from a metastasis in which practically all of the tissue was cancer cells.

Dr. O. Lowy, Newark, N. J.: I have done considerable work in dialysis and have found that, as Dr. Wohl has brought out, the question of boiling is very important. To do away with some of the uncertainty I boil my solutions in a water-bath and instead of boiling for one minute I boil them for ten, using the four-thimble method and the activated serum. At the end of ten minutes I read the result. In using the flame a different heat is obtained according to the position in which the test-tube containing the serum is held, whether toward the center or end of flame. Another method to which I resorted to overcome error is: in a positive result I retest that same thimble at once against albumin. If the albumin gives a positive result my test is of no value. If it is negative I test against peptone. If that is positive I know that my test is right. As far as the value of the test is concerned, only the cumulative evidence of thousands of cases will do that. Up to the present we have tested 150 to 180 cases of cancer. In a number of cases of diabetes I have obtained a positive result; why, I do not know.

Dr. A. J. Carlson, Chicago: There is a fundamental discrepancy between one of Professor Abderhalden's statements and one of the main points in Dr. Vaughan's paper. Abderhalden takes the position that normal blood contains no polyvalent proteolytic enzymes, while Dr. Vaughan maintains that "the blood is a digestive fluid." Just there lies the main source of error in the practical utility of the Abderhalden test. I have had no personal experience with this test, but I have done some work on the ferments of the blood. I cannot accept Abderhalden's dictum as to the absence of polyvalent ferments in normal blood. I predict that normal blood will be found to contain polyvalent ferment or ferments, that when specific proteins are liberated into the blood, specific ferments are produced. That means that the Abderhalden test must be, not a qualitative, but a quantitative one. Of course I admit that the question whether or not normal blood-serum contains polyvalent ferments is a difficult one to decide. We have no means of obtaining serum identical with the plasma of the circulating blood. Dr. Vaughan emphasizes particularly that the leukocytes and the blood platelets are the source of some of these ferments. That may be partly true, but I wonder whether he is not unduly influenced by the distinguished gentleman across the water—Metchnikoff. In regard to many of the immune bodies I am confident on the basis of work by Dr. Hektoen and myself that tissues other than the leukocytes are the most important.

Dr. Henry Schwarz, St. Louis: I wish to say, since a great many men are influenced by the technic which I had

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given out, that there is one point about boiling the thimbles which was incorrectly stated in my paper read at Providence, R. I. I there stated that I boiled the thimbles five or six minutes. I do not. Such boiling spoils the thimbles, rendering them impermeable. We simply dip them in boiling water for not more than fifteen seconds, as Abderhalden suggests. A great many men with just as much training as Dr. Falls undoubtedly has, and with similar experience, have found when they published their results and their methods, that some little point of technic was wrong, which upset the whole matter. We are all willing to admit that the thing is not quite ready for everybody to work with; we are not quite ready to advise serodiagnosis of pregnancy or cancer, on a commercial basis at any price. We would not take any money for it, but we are all working in the same field and we are trying to make good. There are others who are not obtaining convincing results. Come to St. Louis, we shall be glad to show you in our laboratories the work that we are doing.

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THE PRESENT STATUS OF PYELOGRAPHY

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Sufficient evidence is furnished by the excellent work of Braasch and many others to establish without question of doubt the value of pyelography in the diagnosis of surgical diseases of the kidney and ureter. Additional testimony based on our own experience would mean merely a repetition of what has already been stated. Another phase of the subject, which is of equal importance and forms the theme of this paper, is the consideration of the harmful results that may follow collargol injection, its indications and limitations.

When we first began the use of pyelography, we shared the opinion of others that the injection of collargol into the renal pelvis was free from danger and employed it routinely in all cases presenting symptoms which might be due to renal pathologic conditions. In the course of time we became convinced of the error of such a procedure. With increasing knowledge acquired from our own experience as well as that of others, we have put a decided limitation on the cases suitable for injection and have formulated a technic which we believe will reduce the disastrous sequelae of pyelography to the minimum.

That collargol produces little or no irritation of the pelvic mucosa seems to be proved by clinical and experimental evidence. Following injection in twenty of our cases, the urine rapidly lost the collargol stain, and microscopic examination was normal or showed

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only a slight excess of leukocytes with an occasional erythrocyte. Kidd[1] reports similar results. In his discussion of Kidd's paper, Walker states that he "has operated on a number of cases within a few days of the collargol examination and in every case the lining membrane of the renal pelvis was healthy and glistening even when the pelvic contents were deeply stained with collargol. In some cases where nephrectomy was performed the mucous membrane was normal microscopically." This coincides with our own findings; in both specimens illustrated in this paper, the lining epithelium of the pelvis is normal although the kidney shows wide-spread changes. Blum,[2] on the other hand, reports extensive necrosis, but, as Strassmann[3] points out, his experiments are open to criticism in that he used post-mortem specimens, and the changes which he ascribes to collargol could well have been cadaveric. The burden of proof, therefore, is that, so far as the renal pelvis is concerned, collargol is harmless.

That the injection may have a decidedly injurious effect on the kidney has been shown repeatedly and almost without exception; the pathologic reports detail the same results, namely, the tubules filled with collargol, which may extend into Bowman's capsules, rupture of the tubules, peritubular round-cell infiltration, renal infarcts or areas of cortical necrosis. Strassmann alone maintains that the tubules are free, the collargol being taken up by the renal lymphatics or tissue clefts. The experimental work of Tennant,[4] Oehlecker,[5] Kidd and others, conclusively proves that collargol gains entrance to the kidney by way of the tubules and that the extent of involvement is directly dependent on the degree of pressure exerted in making the injection as well as the time that the solution is allowed to remain in the pelvis. The same results are

1. Kidd, Frank: Proc. Roy. Soc. Med., 1913, vii.
2. Blum: Wien. med. Wchnschr., 1912, No. 19.
3. Strassmann: Ztschr. f. urol. Chir., March, 1913, p. 126.
4. Tennant: Ann. Surg., 1913, lvii, 888.
5. Oehlecker, F.: Fortschr. a. d. Geb. d. Röntgenstrahlen, 1911, xvii, 195.

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reported clinically by Mason,[6] Tennant[4] and Troell.[7] The accompanying photomicrographs (Figs. 1, 2 and 3) depict similar conditions. These injections were made during our earliest experience in pyelography and represent the ill results that may attend imperfect technic in types of disease in which, if used at all, the injection must be made with the greatest skill and care. Severe pain followed both injections and confirms Tennant in his statement that pain following collargol injection may have a graver significance than the mere overdistention of the pelvis, indicating the passage of the solution into the renal parenchyma.

The question naturally arises, Is the kidney permanently or seriously injured by collargol in the absence of superadded infection or such extensive lesions as infarction or necrosis? Pathologic evidence and clinical experience seem to indicate that this can be answered in the negative. Leukocytes, a few red blood-cells and hyaline casts may be present immediately following injection, but these soon disappear. Even in those cases in which violent pain and high fever have followed, such as reported by Vest[8] and Zachrisson,[9] the urine sooner or later returns to normal.

Evidence is available, therefore, which shows that wide-spread lesions of the kidney may result from collargol injection and as a rule go hand in hand with overdistention of the renal pelvis. In many cases, collargol may find its way into the straight tubules, but the resulting irritation of the renal parenchyma is usually trifling and produces no permanent injury. That a substance may be found which will be non-irritating as well as impermeable to the Roentgen ray is to be hoped for. Kelly and Lewis[10] advocate silver

6. Mason, J. M.: Dangers Attending Injections of the Kidney Pelvis for Pyelography, THE JOURNAL A. M. A., March 14, 1914, p. 839.
7. Troell: Hygiea, 1913, 75, p. 176; ref. in Zentralbl. f. ges. Chir. u. d. Grenzgeb., 1913, i, No. 16. p. 829.
8. Vest: Bull. Johns Hopkins Hosp., March, 1914, p. 74.
9. Zachrisson, F.: A Case of Collargol-Injection into the Tubuli Recti of the Kidney, Nord. Med. Ark., 1911, xi, ref. in Zentralbl. f. Chir., 1911, No. 50.
10. Kelly and Lewis: Surg., Gynec. and Obst., 1913, xvi, 707.

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iodid but their report is too meager to warrant acceptance until further accurate experimental and clinical evidence is submitted.

Our experience, together with a study of the cases reported in literature, convinces us that too much stress has been put on the supposed corrosive action of collargol, while in reality the fault lies in the method of injection or its application in types of disease which favor rapid permeation of the renal tissue.

As the result of his experiments with Berlin blue and other inert anilin dyes, Marcus[11] demonstrates with what ease trauma to the pelvis and kidney may be produced by even low pressure. If no injury were present, the coloring-matter merely lay in the pelvic clefts or ascended occasionally into the collecting tubules at the papillae, but was never found in the intratubular tissue. When the dye was found in the veins of the kidney, he invariably demonstrated a traumatic site of entrance in the pelvis or renal parenchyma. Under high pressure, it was an easy matter to produce a migration of any inert substance from the pelvis to the renal vein by way of the kidney, with emboli in various organs. He also shows, experimentally, that the site of rupture determines the area permeated by the dye which may be found in the renal vein, the subcapsular space or the peripelvic tissue.

The experimental work of Lewin [12] was done along similar lines and with like results, although he does not emphasize the importance of trauma as the exciting factor in permitting the escape of the injected fluid. Emboli were found in the right heart, lungs and liver, corresponding to the recent report of Eisendrath[13] and differing only in the fact that he used an anilin dye instead of collargol. The experiments of Strassmann, Kidd and Tennant, previously referred to, substantiate

11. Marcus: Wien. klin. Wchnschr., 1903, No. 25.
12. Lewin: Arch. f. exper. Path. u. Pharmakol., 1897-98, xl, 287.
13. Eisendrath, Daniel: The Effect of Injecting Collargol into the Renal Pelvis, THE JOURNAL A. M. A., May 2, 1914, p. 1392.

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the findings of these investigators and show the possibilities of danger which attends injection under high pressure, and also the relative freedom from danger when little or no distention of the pelvis is produced.

It is doubtless true that, in the earlier days of pyelography, many instances of severe pain or disastrous results following injection were due to an erroneous conception concerning the capacity of a normal pelvis. At that time the limits were stated by various observers as varying from 15 to 30 c.c., while at present we know that the capacity is between 2 and 5 c.c. It is only natural to assume, therefore, that, in making the injection, the normal capacity was many times exceeded.

We are firmly convinced that solution of continuity of tissue, whether by ulceration, or direct or indirect trauma, plays an important rôle in permitting the escape of collargol from the pelvis. The work of Marcus already referred to shows how even low grades of distention can break the pelvic lining in normal kidneys. In kidneys altered by disease, whether this be a thinning out as in hydronephrosis, an ulceration as in tuberculosis or tumor, or increased friability due to pyogenic infection, it is self-evident that ruptures of varying degrees are more prone to result. Of the reports in literature of cases in which extensive changes have been produced by collargol, it is interesting to note three cases of hypernephroma (Mason, Oehlecker and Rössle[14]), one case of pyonephrosis (Troell) and one case of suppurative pyelonephritis (Schwartzwald[15]).

To these we add the cases herein reported, one of early tuberculosis and the other chronic pyelonephritis and hydronephrosis (Fig. 4). This is sufficient evidence to indicate that such lesions may act as at least

14. Rössle: Tödliche Kollargolvergiftung, München. med. Wchnschr., 1911, lviii, 280.
15. Schwartzwald: Beitr. z. klin. Chir., lxxxviii, No. 2.

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contributing factors in the dissemination of collargol throughout the kidney, since they furnish ideal conditions for the production of a portal of entrance.

The effect of direct trauma by the ureteral catheter is nicely shown in the specimen of Mallory reported by Mason: "The collargol was injected into the kidney tissue as a result of running the catheter too far into the pelvis of the kidney. Evidently the point of the catheter went into a calyx and the fluid was injected under pressure into that calyx." Any one experienced in ureteral catheterization knows that unless the greatest care is used, it is an easy matter to traumatize the pelvis sufficiently to produce bleeding and thus bring about a condition similar to that seen in the specimen just mentioned.

Reviewing the cases reported in literature from the clinical point of view, pain following injection is the most frequent symptom. This may be very severe, requiring morphin for its relief, and persists for several hours or even days. Pain may follow the most careful manipulation in passing the catheter or the injection of only a few drops of collargol. In our experience this has occurred only rarely; when severe pain has resulted, it has been due to our faulty technic of catheterization or injection. When pyelography was first undertaken, we were inclined to ascribe this pain to the irritation of the collargol, and varied the percentage of the solution from 1 to 10, with no apparent relationship between the strength of the solution and the intensity or absence of pain. It was evident that some other factor was active. We found that the frequency of pain was greatly diminished by inserting the catheter only part way up the ureter instead of into the pelvis. This plan is open to criticism in that it gives no idea of the pelvic capacity, but it does indicate that the avoidance of trauma to the pelvic mucosa is an important factor in lessening the harmful results, of which pain is often the only

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symptom. As further proof of the ill effects of trauma, we have observed that pain almost constantly accompanies injection in cases in which bleeding follows catheterization.

The second and by far the most important cause of pain is overdistention of the renal pelvis. Whether we accept the evidence of Marcus that overdistention produces solution of continuity of the pelvic lining, or of other observers that the collargol ascends directly into the straight tubules without previous pelvic injury, the fact remains that, as a rule, the degree of permeation in the kidney is in direct relationship to the amount of pressure exerted by the distending medium.

We are in full accord with Tennant's statement that pain indicates in many instances the passage of collargol into the kidney tubules, and is not merely a colic incident to an overfilled pelvis. If the latter were true, the pain should cease shortly after the relief of pressure rather than persist for hours or days. We ascribe it to increased tension of the renal capsule, produced primarily by the sudden increase in volume of the kidney due to the entrance of collargol, and secondarily to reactive changes within the kidney incident to the injection of a mildly irritating, foreign substance. In seventy cases in which the piston syringe was employed, pain resulted in over 10 per cent.; in our last thirty cases, we have used the gravity method of injection as recommended by Thomas[16] with no pain whatever, proving conclusively its great advantage over the older method.

Several cases are reported in which fever has followed injection, persisting for days and in a few instances attended by the development of perirenal suppuration. As first pointed out by Voelcher and observed by Braasch and many others, collargol is not

16. Thomas, G. J.: An Apparatus for the Injection and Lavage of the Pelves and the Ureters, THE JOURNAL A. M. A., Jan. 18, 1913, p. 184.

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uncommonly found in the peripelvic tissue and produces little or no inflammatory reaction. We are convinced that a rise in temperature is due not to collargol *per se,* but that faulty technic has permitted the introduction of infection, with collargol as the medium by which it is carried to the kidney or its surrounding tissues.

Lastly, three deaths are reported as occurring after collargol injection. The often-quoted case of Rössle has been criticized by Strassmann who advances arguments which tend to disprove that collargol was the cause of death. More recently a second case is reported by Rosenblatt and Morgandies,[17] in which a state of shock developed at the time of injection with death several hours later. In this case of suspected hydronephrosis, 40 c.c. of a 5 per cent. collargol solution was injected without difficulty. A post-mortem examination was not performed nor was the kidney examined microscopically. The perirenal tissues were widely infiltrated with collargol, there was no collargol in the pelvis or ureter and only a "minimal" tear was visible in the kidney tissue. In a case reported by Vest, death resulted on the fourteenth day after operation. Acidosis and acute dilatation of the stomach were postoperative complications. Vest does not assert that death was due to collargol poisoning, but draws attention to the interesting fact that, as in Rössle's case, hemorrhagic diathesis developed a few days before death. In his preliminary report, Eisendrath has shown experimentally that death may result from emboli in various organs, but this has occurred only when collargol was injected under very high pressure. That similar results may follow injection in man is of course true, but with ordinary care and skill, we can state without fear of contradiction that this danger can be entirely eliminated.

17. Rosenblatt and Morgandies: Verhandl. d. deutsch. Röntg. Gesellsch., 1913, ix, 81.

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CYSTOSCOPIC TECHNIC

Basing our ideas on experimental evidence as well as clinical experience, we have formulated certain points in technic which, in our opinion, are of importance in avoiding the untoward results of collargol injection. The greatest care as regards asepsis cannot be too strongly emphasized. The ureteral catheter should not exceed No. 6 in size, it must be free from rough surfaces and pliable so as easily to follow any change in the course of the ureter; to avoid trauma, we never use a stiletted catheter. The catheter is inserted for a distance of 20 cm. and its further progress is made extremely slowly until the slightest buckling occurs, which indicates that its tip has reached the pelvis. It is then withdrawn 1 or 2 cm. and the character of the urinary outflow is observed to determine, if possible, the presence or absence of pelvic dilatation. The catheter is then withdrawn 10 cm. and the injection made. By so doing the danger of wounding the pelvis is minimized and the tip of the catheter is below the level at which the majority of ureteral kinks are found.

If the urine is blood-stained, the injection is not made, a subsequent examination being advised at an interval of at least seven days. When an obstruction is encountered along the ureter, we do not attempt forcibly to overcome it, but pass a smaller catheter; if its passage is likewise impeded, the collargol is injected and in the majority of instances, will find its way upward. The forcible passage of the ureteral catheter is to be condemned under any circumstance, but this is especially true when injection is to follow. We are opposed to the routine practice of simultaneous injection of both kidneys; when bilateral disease is suspected, the injections are made at two sittings. If for any reason, the roentgenogram is unsatisfactory, we make it a rule to allow several days to elapse before attempting a second injection.

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The collargol is freshly prepared for each case; the crystals are thrown into a small mortar containing boiling water and when cooled are thoroughly dissolved by stirring with a pestle. The solution is filtered through cotton and gauze and is ready for injection. The strength of the solution varies from 5 to 10 per cent., depending on the thickness of the abdominal walls. In making the injection, we use a 30 c.c. buret connected with a short tube and stopcock. To start the flow through the catheter, elevation of the buret to about 3 feet will be necessary but it is immediately lowered and allowed to flow in at an elevation of not more than 1 foot with a No. 6, and 2 feet with a No. 5 catheter. The injection is discontinued when the column of collargol ceases to fall or the patient experiences the first slight sensation of fullness in the kidney region. After the picture is taken, the collargol is drained off and the catheter removed.

We make it an invariable rule to keep our patients under observation in the hospital for twenty-four hours after injection and prescribe copious draughts of water during the first six hours. When retention from angulation of the ureter due to ptosis is suspected, the patient is required to remain in bed for twelve hours after the injection. This facilitates free drainage of any collargol that may remain in the pelvis of the kidney.

ROENTGENOGRAPHIC TECHNIC

The diagnosis of renal and ureteral conditions by pyelography depends on the correct interpretation of the roentgenogram made immediately after a careful ureteral catheterization and injection with the opaque solution. While each step is of equal importance, and each without the other is of little or no value, roentgenography plays but a minor part in the procedure as a whole. It is to be regarded simply as a means of accurately demonstrating and recording what the

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cystoscopist has done. The real value of the method arises in a very large measure from the technic of the cystoscopist in creating correct appearances for the roentgenogram to portray in order to demonstrate existing conditions accurately.

When employed as a safe and necessary procedure, pyelography has a very limited range of application as compared to the usual routine roentgenoscopy of the urinary tract. It is to be employed, as a rule, therefore, only after the usual methods have failed to show any condition satisfactorily explaining the clinical phenomena present. Certainly, whenever calculus is suspected, the usual routine roentgenoscopy should always be resorted to first, as the injection of collargol may not only be unnecessary but is likely to interfere with the detection of a stone, especially in the kidney. Instances are recorded, on the other hand, in which the colloidal silver injection has rendered a calculus sufficiently opaque to cast a perceptible shadow when it was not detected by the simple roentgenoscopy alone. We are able to cite one experience of this kind in connection with a ureteral stone which was distinctly shown by the collargol injection, whereas no shadow could be detected in roentgenograms made at previous and subsequent examinations in the usual manner. Of course, such instances are exceptional.

There is little to be said of the roentgenographic technic *per se*. Preliminary preparation of the patient is always essential, and comprises the withholding of food, pills and tablets, and the thorough evacuation of the intestinal tract. As we have found castor-oil disagreeable and not always satisfactory in removal of gas, we have recently adopted the use of compound cathartic pills pulverized and administered in capsules, and have found this procedure more efficacious.

Compression, which is so essential in the usual roentgenoscopy of the urinary tract, had best be avoided in connection with pyelography, for obvious

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reasons. When stout individuals are to be examined, the intensifying screen may become essential, if not used routinely.

In the early days of pyelography, Stover advocated the use of a table whereby one exposure could be made in the usual horizontal posture, and repeated immediately in the semirecumbent or vertical position by tilting the table. Such a procedure is obviously useful in the diagnosis of ureteral kinks associated with movable kidneys, but we have found it by no means essential. The substitute performance of having the patient get off the table and stand for the second exposure is to be condemned.

In our analysis of the cases reported in literature, it is evident that the harmful effects of collargol have, in many instances, been due to sins of omission or commission on the part of the operator and should not be held to the discredit of the injection itself. On the other hand, it has been shown that, even with the greatest skill and care, there are possibilities of danger which should serve as a warning against the indiscriminate injection of collargol, irrespective of the underlying pathology. For this reason, we resort to pyelography only when an accurate diagnosis cannot be made by other methods of examination.

We are opposed to its use in depicting interesting anomalies when such a procedure means merely a graphic representation of what may be accomplished by the method. We are likewise opposed to its indiscriminate use in all types of renal pathology; for experimental as well as clinical evidence indicates that possibilities of harm are certainly increased in the presence of ulceration, infection or retention of the solution in the pelvis. For this reason, with only rare exceptions is the injection made in suspected cases of neoplasm, tuberculosis or large hydronephrosis. Likewise, in those infections other than tuberculosis, we hesitate to employ collargol until other methods of

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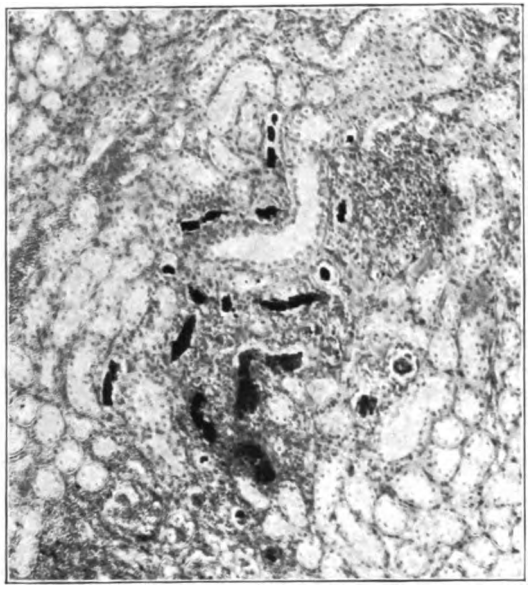

Fig. 1.—Early tuberculosis of the kidney. From photomicrograph. Intense infiltration of collargol throughout all portions of the section, with well-marked destruction of kidney structure. High pressure used in making the injection.

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Fig. 2.—Same specimen as shown in Fig. 1. From photomicrograph. Argyrol in Bowman's capsule, also permeating the kidney tissue with a moderate degree of necrosis and round-cell infiltration.

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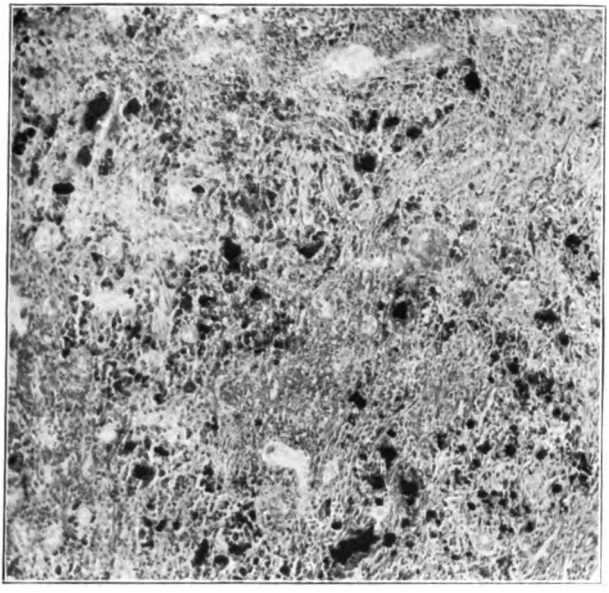

Fig. 3.—Pyelonephritis and hydronephrosis. From photomicrograph. Fifty c.c. of a 10 per cent. argyrol solution were injected under high pressure. In this section the argyrol is confined within the tubules; the kidney tissue is well preserved.

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Fig. 4.—Calculus pyonephrosis showing diffuse permeation of collargol throughout kidney. Type of case unsuitable for pyelography.

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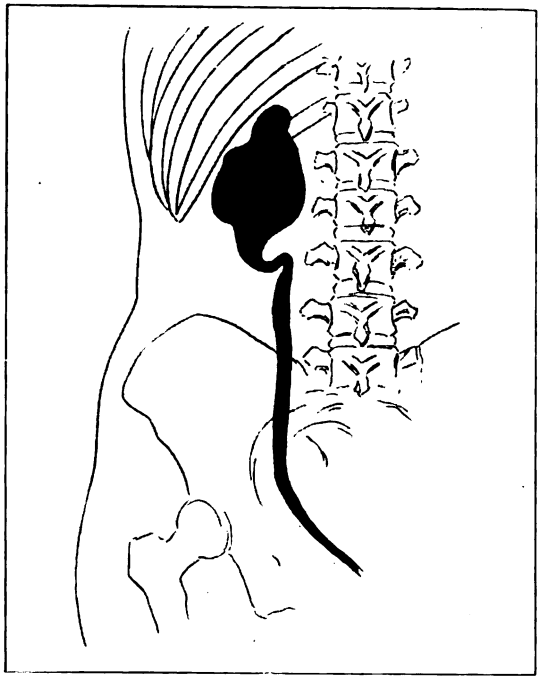

Fig. 5.—Colon bacillus pyelitis with marked dilatation of pelvis due to ureteral kink. Symptoms relieved by pelvic lavage. The usual methods of treatment together with autogenous vaccines had been unsuccessful.

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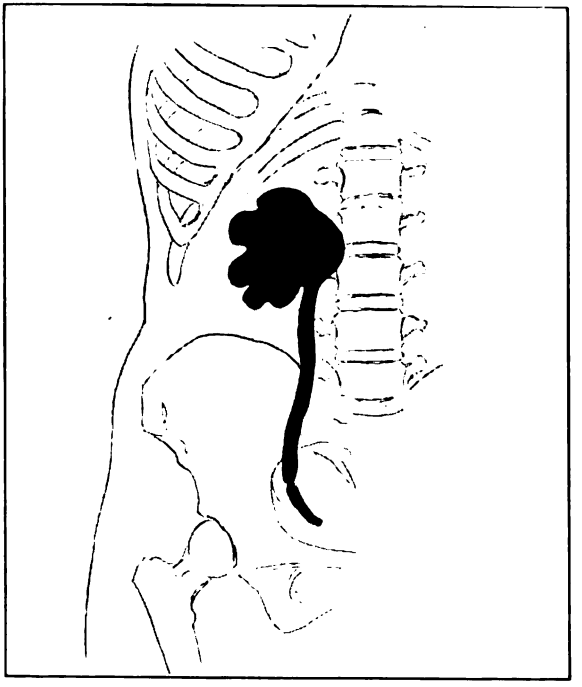

Fig. 6.—Stricture of ureter. Marked dilatation of ureter above stricture, and pyelonephritis of gonococcal origin. Pyelography was employed in order to eliminate calculus as a possible cause of ureteral obstruction. Lavage and collargol instillation resulted in temporary improvement.

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Fig. 7.—The roentgenogram failed to demonstrate a calculus. The catheter met an obstruction 13 cm. from the ureteral orifice. By means of a collargol injection, the calculus was clearly defined, together with a hydro-ureter and hydronephrosis.

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Fig. 8.—History in this case indicated ureteral calculus. A small cystic mass lay to the side of the uterus and the roentgenogram showed a shadow along the course of the ureter. Pyelography demonstrated a normal pelvis and ureter and an extra-ureteral shadow, which operation proved to be a tooth in a dermoid cyst.

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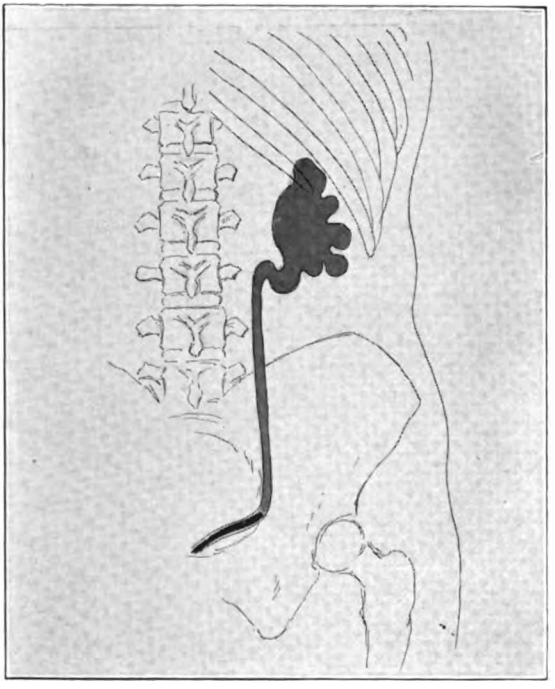

Fig. 9.—Ptosis of the left kidney with hydronephrosis. The catheter met an obstruction 4 cm. from the ureteral orifice. Pyelography demonstrated that the obstruction was not pathologic, but due to an abrupt change in the course of the normal ureter.

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Fig. 19.—Beginning dilatation of the pelvis in a case of nephroptosis.

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diagnosis have been exhausted. It is of the utmost importance in the treatment of pyelitis to determine whether we are dealing with a mechanical dilatation of the pelvis with superimposed infection or with a true primary infectious pyelitis, and if other methods fail to reveal the desired information, the risk of pyelography is far outweighed by the accurate data which it affords.

When renal or ureteral calculi can be definitely recognized in the roentgenogram, little or no additional information will be afforded by pyelography; the injection is indicated only when the position and character of the shadow make it impossible to determine whether it lies within the kidney or ureter or in adjacent structures. This applies especially to those cases in which in addition to the shadow along the course of the lower ureter, the catheter meets with an obstruction at a corresponding level. Such evidence is of course strongly in favor of calculus, but is by no means positive, since inability to pass the catheter above a certain level is not infrequently due to an abrupt change in the course of the normal ureter. This point will be quickly determined by the presence or absence of ureteral dilatation above the site of obstruction.

The pyelograph serves its greatest field of usefulness in detecting the earlier stages of hydronephrosis due to mechanical blockage of the ureter other than that caused by stone. In fact, it is the only means at our command which permits the diagnosis to be made without question of doubt. This applies likewise to certain congenital anomalies, especially the horseshoe and the dystopic kidney. Under these circumstances, if proper technic be employed, collargol injection can be made with but the barest possibility of harmful sequelae.

That exceptions to these general rules in the selection of cases will arise from time to time, is quite

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obvious, but such exceptions are rare, and in no way detract from the general principles which we have formulated for our own guidance. We may err on the side of conservatism, but we are satisfied that it is likewise on the side of safety, for we are convinced that possibilities of danger exist even under the most ideal circumstances. In the majority of instances, however, disastrous results following collargol injection have been due not to the use but to the abuse of the method, and we are confident that if greater care be given to the technic of injection as well as to the selection of cases, the dangers of pyelography will be of minor importance as compared to the valuable information which its use will afford.

116 South Nineteenth Street.

ABSTRACT OF DISCUSSION

DR. W. F. BRAASCH, Rochester, Minn.: Undoubtedly Drs. Keene and Pancoast should be given great credit for calling attention to the possibility of harm from the use of pyelography. If we recall the history of cystoscopy and ureteral catheterization, illness and death were reported following its use, so that for a while the method fell into discredit. Ureteral catheterization was criticized so severely that many would not permit patients to be so treated. I am under the impression that most of the harmful results following pyelography could have been avoided with the proper technic and selection of cases. It is peculiar that the deaths recently reported as being due to pyelography have not been in the hands of men of extensive experience in its use. In over 2,000 cases in which pyelography has now been employed at the Mayo Clinic, we have no record of any fatality which could be ascribed directly to its use. I have, however, observed three cases in which cortical lesions were found in the kidney at operation following pyelography. The kidneys in these cases were all hydronephrotic and with our present knowledge of the danger in pyelography we would not have employed it. They were otherwise surgical kidneys so that the complication did not affect the ultimate result. It should be a fundamental rule never to manipulate the urinary tract any more than is absolutely necessary for diagnosis. The injection of colloidal silver for pyelography may be followed by tissue infiltration only under two conditions: namely, (1) if drainage from the pelvis is interfered with; and (2) if the pelvis is overdistended. By means of the gravity method we

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have overcome the dangers of overdistention; by carefully selecting our cases, we can usually overcome the dangers of retention. The ideal substance should be sufficiently liquid to be used in the gravity method, and one which would not cause necrosis if retained. The silver iodid advised by Kelly and Lewis may prove to be a valuable adjunct. It cannot be employed in the gravity method, but must be employed with the syringe because of its viscidity. Our endeavor should be to find some substance which can be injected without causing any harm to the kidney substance under any conditions. Pyelography, however, will probably never be a method of diagnosis which can be generally used. It should be employed only in the hands of men with wide experience with diagnosis of the various conditions in the urinary tract.

Dr. Henry Dawson Furniss, New York: There are still many dangers in pyelography, due to the mechanical insult of its performance and to the irritating effect and toxicity of the substances used. The ideal substance must be non-irritating, non-toxic and soluble in both water and the blood. Eisendrath has done some good experimental work in the injection of argyrol and collargol under pressure, and has found these substances not only in the tubules of the kidney, but also in the interstitial connective tissue, as well as in other organs of the body. The wide distribution he found due to entrance of the collargol through ruptured veins. In the Genito-Urinary Section were reported four or five fatalities following the use of collargol. In some, death was within a short time and in others followed within ten days or two weeks. In these late fatalities a hemorrhagic condition developed, with bleeding from the mouth, nose, stomach and under the skin; there were superficial ulcers in the mouth. In making pyelographs, my technic is to fill the bladder with boracic acid solution, put the patient on the table, have the Roentgen-ray plate and tube adjusted, then catheterize the ureter using a soft No. 5 or 6 catheter, clamp the cystoscope in position with a holder, and then make the injection under gravity. This saves a lot of unnecessary moving of the patient, which is disagreeable and tends to displace the catheter. The soft catheter is used, as stiff ones are capable of injuring the kidney substance so that the collargol can enter the circulation of the kidney substance. By using small catheters there is less danger of harm, as the collargol can escape alongside of the catheter. Even with the most careful technic severe pain often attends making a pyelograph. I am of the opinion that the pain is due to other factors than the simple distention, as I have never noticed such long and severe pain in the cases where I have distended the renal pelvis for diagnosis according to the method of Kelly. I agree with Drs. Keene and Pancoast that pyelography is a most valuable diagnostic aid

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and one to be used only when other methods do not furnish us the necessary knowledge. It is especially useful in early hydronephrosis and easily passable strictures of the ureter.

Dr. D. N. Eisendrath, Chicago: I have had occasion to use pyelography a great deal but have felt that I was not justified in using it with the syringe, unless I knew just where the danger-line was. In my first case the patient, who was 54 years old, died within half an hour after the injection. I made up my mind there must be some reason why the collargol in the urine caused trouble. We knew that the gravity method was apparently the safest and so we elevated a column of collargol 3⅓ feet above the level of the table and caused a pressure of 30 mm., injecting a certain series of animals with 10 per cent. collargol, about 8 ounces, and killed them at different intervals. We were the first to use the manometer and by measurement were able to state the exact amount of pressure used to inject the collargol into the high renal pelvis. In this first series there were no changes; we could find no collargol except in one kidney. We had proved, experimentally, that the collargol was perfectly safe so long as we did not raise the pressure above 30 mm. In the second series we increased our pressure from 30 to 70 mm. and still kept as close as we could to the capacity of the renal pelvis of the dog—from 2 to 7½ c.c.—seldom over 5 c.c. The animal lived. There was collargol in the lungs, in small quantity in the liver and in the kidney. In the animals that lived for thirty days after the experiments, what Drs. Keene and Pancoast have said, was true; the collargol did not kill off the epithelium, but we got much inflammatory reaction. Then we decided to increase our pressure. The first animal in this series we subjected to a pressure of 100 mm. and injected 20 c.c. and it died in five minutes from the time of beginning the injection. By the time the last of the fluid was in, the animal was dead. At necropsy we found that the lungs were perfectly black. They evidently had been filled completely with the collargol. The collargol filled every capillary of the lung as if injected for histologic purposes. The liver showed nodules, with quantities of collargol in the form of infarct deposits. It was evident that when the collargol was injected it went up through and between the tubules and broke into the veins. We had to make almost a hundred sections before we could get one which showed the collargol breaking into the veins. In one specimen, with 20 per cent. collargol solution injected under considerable pressure, the collargol was shown actually breaking into a vein. The other high-pressure series showed that the animals which lived longer than a few minutes or half an hour had all the pulmonary symptoms and hemorrhages corresponding to the human cases from hemorrhagic infarcts or pneumonia. I

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believe that the dangers lie entirely with the use of high pressure and the combination of the mechanical and toxic actions of the silver.

Dr. Arthur E. Hertzler, Kansas City, Mo.: The great toxicity of silver is just beginning to be recognized. Twelve years ago I published a paper on this subject. Silver is very active in solution of 1:10,000. The manner in which it works is a matter of much controversy. It used to be said that a silver albuminate is not produced. It is astonishing how small an amount of carbon will produce a large amount of black substance. A single c.c. in a large-sized rabbit will stain a whole peritoneum and cause death. The capacity of the epithelium to prevent absorption is lost and the silver continues further down. The question is, How does the silver get to most parts of the body? I have made a large number of sections of all the organs of the body and sometimes found in the connective tissue bits of silver deposit. It looks as though the silver got there in solution. Yet from the general action of silver this seems impossible. When silver breaks into a vessel it attacks the leukocytes and these leukocytes travel to the distant organs. The question is, What kills the animals? Nowhere do deposits of silver seem to be enough for this.

Dr. John G. Clark, Philadelphia: This clinical method like many others, is open to criticism if it is done badly, but, after all, does not the same criticism apply to many valuable methods in vogue in other branches of medicine? If pyelography is practiced under such careful restrictions as are laid down by Drs. Keene and Pancoast, it can only be of great benefit and in no instance have I seen a single untoward result. In one case in which the ureter had been catheterized by Dr. Keene there was acute pain followed by a slight rise of temperature. I was under the impression at the time that a collargol injection had been made and was inclined to criticise the method. I found, however, that only a simple catheterization had been done and there could therefore be no reflection on this valuable method which we are discussing. Subsequently, this same patient had a collargol injection and not the slightest reaction followed it. In gynecologic work, as was shown in a paper which Dr. Keene and I published last year, irritability of the bladder is a very common symptom; so common, indeed, that many times it is accepted without question as coming from some pelvic disability. Oftentimes a gynecologic operation is done which is not followed by relief and the patient is looked on as a neurasthenic. In many of these cases, a cystoscopic examination with a pyelographic study clears up the doubt at once and locates the difficulty either in the ureter or the kidney. A large number of such cases have come under our care and I have the very highest regard for

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this work and feel that it has a most important place in our diagnostic methods. Even if we assume there is occasional danger, the method is so valuable in the aggregate that I do not feel it should be discarded. It it is carried out with the care which Dr. Keene always observes in his work there is no danger. I have been delighted to hear the favorable trend of the discussion. This line of investigation typifies the accurate methods in many other branches of medicine, but only those who possess special skill should have charge of this class of cases. Even though the surgeon may be ever so skilful, he may not have the requisite training to arrive at proper conclusions if he attempts to apply this method himself, and, therefore, such cases should always be referred to men who through constant practice are especially skilled.

Dr. Henry K. Pancoast, Philadelphia: Most of the remarks we have heard have been made from the point of view of the cystoscopist, and it might be well to say something from the roentgenologist's point of view. Three things are essential for correct diagnosis by this method: (1) injection by one who thoroughly understands his work; (2) the making of the roentgenographic record; (3) correct interpretation of the findings. The roentgenologist is sometimes placed in an embarrassing position, as was recalled by Dr. Braasch's remark that the use of this method should be restricted to a few men. I feel thankful in having to do such work only in a hospital where the examinations are restricted to the services of men like Dr. Keene who know how to use the cystoscope and catheter. On one or two occasions I have seen some very poor work of this kind done. In his own office, at least, the roentgenologist should feel no hesitancy in refusing to examine cases for men who do not fully understand their part of the work.

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A REPORT OF TWENTY-SEVEN UNILATERAL EXCLUSIONS OF THE PYLORIC REGION

WITH SPECIAL REFERENCE TO OPERATIVE TECHNIC

WILLARD BARTLETT, A.M., M.D.
ST. LOUIS

It has been seven years since my first complete unilateral exclusion of the pyloric region was done by cutting tranversely across the stomach and closing the resulting ends blind. It seemed the only logical course of procedure when confronted by an enormous gastric ulcer situated a few centimeters from the pylorus and so extensively connected with the pancreas as to make resection seem inadvisable. The method proved itself valuable in several trials and naturally inspired an interest in its history. Doyen[1] was found to have been the first to record its performance in 1892, while von Eiselsberg[2] reported two operations in 1895 without making mention of the French surgeon's work. For more than a decade following this time, the idea seems to have received little or no further attention until the present wave of enthusiasm for it started a very few years ago. In the accompanying table are reported my first fifteen cases in which the above-mentioned technic was used.

While the anatomic status obtained by complete transverse division of the stomach left nothing to be desired in fifteen cases, still I could not escape the impression that I had thereby added a very definite risk of shock, hemorrhage and sepsis to the risk attending the gastro-enterostomy as such. It was

1. Doyen: Französicher Chiro Kongress, 1893.
2. Von Eiselsberg: Arch. f. klin. Chir., 1895, L.

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about this time that a surgical complication which befell one of our ulcer cases demonstrated the possibility of *functional* exclusion of the pyloric region acting as at least a temporary substitute for the anatomic variety. It came about in this way.

Dec. 23, 1912, we resected most of the minor curvature in removing a large callous ulcer, thereby cutting the stomach more than half way in two. Careful transverse closure of the visceral wound was made, causing the pylorus to approach the cardia in the usual manner, without the lumen being encroached on; still a complete picture of obstruction ensued, persisted six days until a gastro-enterostomy was made, after which the patient speedily recovered. Dr. Soper screened this patient two and one-half months later, finding most of the food passing out through the gastro-enterostomy. (Dr. W. J. Mayo tells me he has had the same experience so often that he now considers immediate gastro-enterostomy indicated after every extensive resection in the minor curvature.)

The suggestion derived from this experience was too obvious to be ignored by one interested in exclusion. It was but natural in the next case to attempt functional exclusion by cutting partly across the stomach (Fig. 1), while at the same time a partial septum (Figs. 2, 3 and 4) was created during the visceral suture, this being the easier method of repair. The incision was made into the major curvature since animal experimentation[3] showed it much better suited than the minor curvature to such treatment. A critical study of these dog stomachs with Roentgen ray, before and after death, showed a high degree of obstruction, while the septa obtained were in every instance much more nearly complete than one could have expected to result from the operation performed. The next three patients were operated on by this method.

3. Bartlett: Am. Jour. Med. Sc., 1914.

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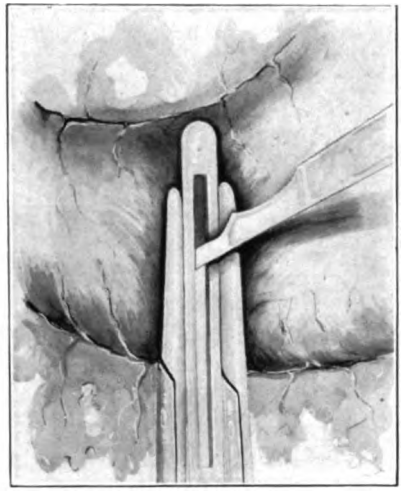

Fig. 1.—Just proximal to the pyloric antrum, an incision is made from the greater curvature two-thirds the way across the stomach through a slit clamp, on either side of which is a crushing-clamp.

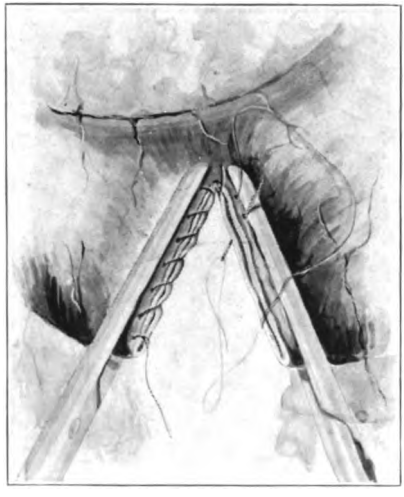

Fig. 2.—The crushing-clamps are separated far enough to permit the introduction of a buttonhole stitch through all the layers.

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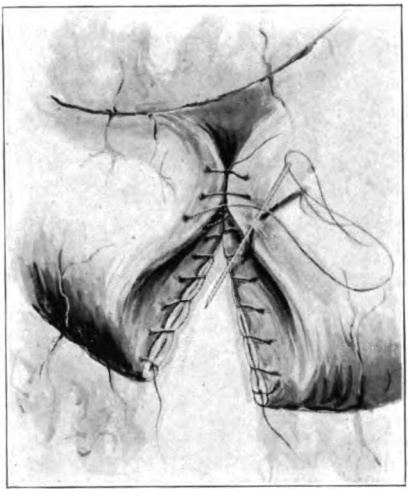

Fig. 3.—The first row is hidden and the V closed by a Lembert row, which runs down the anterior and up the posterior walls.

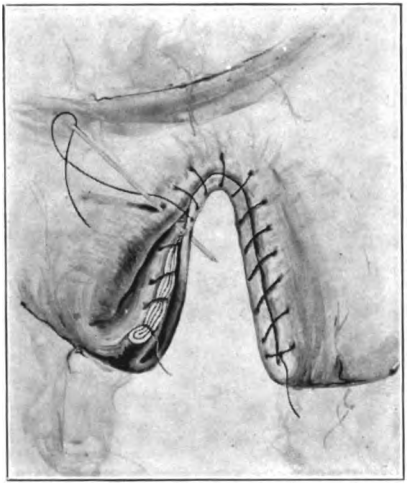

Fig. 4.—The step here described may be used instead of that shown in Figure 3. Here the first row of sutures described in Figure 2 is inverted in the ordinary manner, the V being left open.

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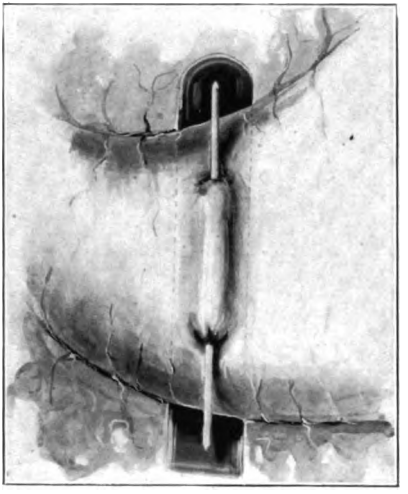

Fig. 5.—A spatula is thrust behind the stomach from below upward and a skewer driven through both walls of the viscus and out again, in such a way that it holds up about half of it when measured transversely. The highly vascular portion of the stomach is not interfered with.

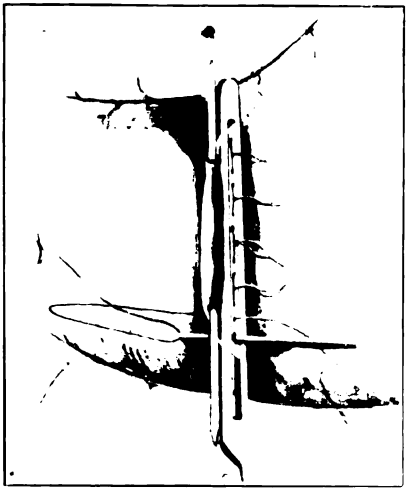

Fig. 6.—A slit clamp is applied behind the skewer and several mattress-sutures introduced through all the layers of the anterior and of the posterior walls.

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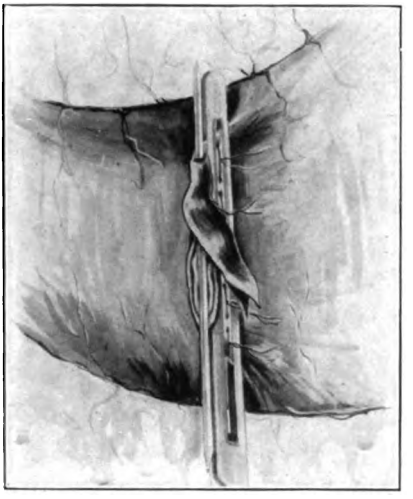

Fig. 7.—The skewer is cut out and the edges cauterized to avoid hemorrhage.

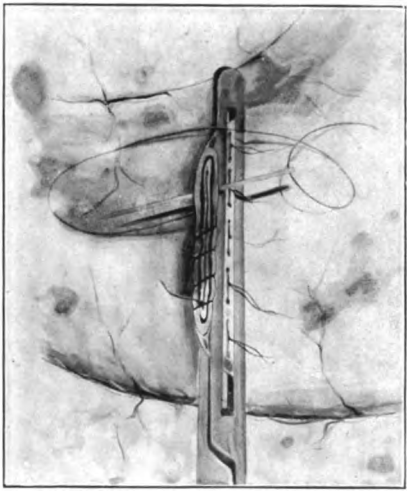

Fig. 8.—A hemostatic buttonhole stitch is introduced through all four layers.

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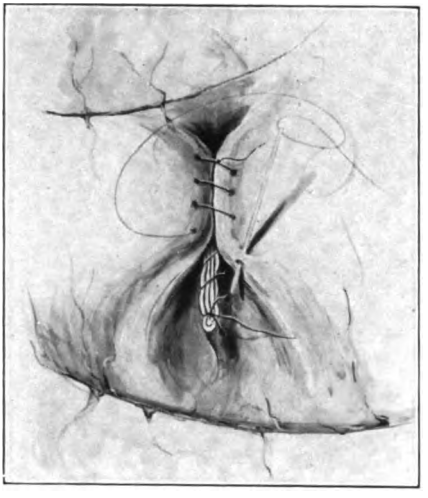

Fig. 9.—The cut surfaces are hidden by a row of Lembert sutures.

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CASE 16.—*History.*—March 31, 1913. Mr. E. A. B., aged 58. Weight 140; always loses a few pounds at this season. For eight years has had pain in stomach coming irregularly after eating and stomach felt distended. Worse in past two years and coming also at night. Lately had attack resembling

REPORT OF FIFTEEN CASES IN WHICH THE FORM OF EXCLUSION WAS TRANSVERSE DIVISION OF STOMACH AND BLIND CLOSURE OF RESULTING ENDS

No.	Name	Location of Ulcer	Present Condition	Time Elapsed
1	Mr. A. L.	One inch below pylorus on upper concavity of duodenum	Died of perforating duodenal ulcer	5 mos.
2	Mr. T. J.	On lower curvature of duodenum 1 inch below pylorus	Died of carcinoma around the duodenal and artificial openings	6 mos., 15 days
3	Miss T. R.	In duodenum below pylorus	Has gained 26 lbs. and is improving	11 mos.
4	Mrs. L. S.	High portion of duodenum	Is greatly improved	1 year
5	Mrs. F. S.	Minor curvature of stomach close to pylorus	Became insane and died	1 yr., 3 mos., 12 days
6	Miss M. L.	Minor curvature of stomach attached to under surface of liver	Died	1 yr., 7 mos.
7	Mrs. A. A.	Highest portion of duodenum	Is in the best of health	2 yrs., 7 mos., 8 days
8	Mr. D. B.	Just behind pylorus	Has gained 13 lbs. Digestion fine	3 yrs., 4 mos., 5 days
9	Miss M. P.	At pylorus	Has gained 13 lbs. Is entirely cured	3 yrs., 5 mos., 15 days
10	Mrs. R. K.	On lesser curvature near pylorus	No improvement	4 years
11	Mr. J. C.	Lesser curvature at pylorus running down to duodenum	In perfect health	4 years
12	Mr. J. L. B.	.....	In splendid health since operation	2 yrs., 8 mos., 19 days
13	Mrs.M.Mc.	Two scars at pylorus	No trouble with stomach since operation	6 yrs., 1 mo., 12 days
14	Mr. J. B.	In duodenum 1 inch below pylorus	Has gained 30 lbs. In excellent health	6 yrs., 3 mos., 4 days
15	Mr. J. P.	In lesser curvature 1 inch from the pylorus	Unable to trace patient	

an obstruction. Good appetite, eats regular substantial food. Is bloated, belches any time and is relieved. Pains come suddenly any time and localize in epigastrium. Is nauseated and takes medicine or induces vomiting to relieve pain. Has a sense of fulness and weight but rests on either side. Bowels are constipated, has been taking aperient for past few months, stools formed, gas easily passed.

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Operation.—April 7, 1913, a greatly distended gall-bladder was exposed, the lower end of which together with the cystic duct, pyloric and duodenal regions was buried in fibrous adhesions. Just below the pylorus was a large indurated area in the posterior wall of the duodenum which was plastered to a mass in the head of the pancreas, the stomach being dilated and displaced downward. Posterior gastro-enterostomy and exclusion of the pyloric antrum. The gall-bladder was brought up to the skin and fastened to be opened later.

June, 1914: Feels better than he has for past ten years. No pain or vomiting.

Case 17.—*History.*—Nov. 28, 1913. Mrs. F. C. D., aged 38. Is losing weight and strength. Since 1912 has had attacks of pain and vomiting after eating relieved by vomiting or gastric lavage. Six weeks ago was in bed for ten days. Stomach strapped up ten weeks ago gave relief for ten days. Can retain solids longer than liquids. Appetite poor, has pyrosis, pain in side and heaviness in stomach relieved by vomiting and lavage.

Gastric Analysis: Free hydrochloric acidity 23, total acidity 61. No occult blood.

Bowels: Progressively constipated.

Physical Examination: Stomach ptotic, kidneys easily palpable and low. Abdominal wall flaccid and loose. Abdomen sore to pressure, more so in the right upper quadrant.

Operation.—Dec. 3, 1913. We were unable to deliver the pyloric portion of the stomach or duodenum, which were completely surrounded by adhesions. The stomach was dilated and low. A posterior gastro-enterostomy was done and the pyloric one-fifth excluded.

June, 1914: Gained 23 pounds since operation. Is greatly benefited but has some pain although it is more neuralgic she thinks.

Case 18.—*History.*—June 4, 1914. Miss M. B., aged 24. About fifteen months ago trouble began with violent pain in stomach, of short duration; had several about every four weeks. Discomfort after eating. Typhoid in September, went to work in November. Stomach O. K. till three months ago. Suffers all the time when at work; better if resting. Appetite not very good, belches right after eating and has a little regurgitation of bitter acid. The pains start high to right midline about one-half to one hour after eating. The gnawing pain begins gradually and passes off suddenly. Food relieves and although there is much nausea only occasional vomiting of small amounts one-half hour after meals. Bowels, regular.

Physical Examination: Muscles rigid, tender to the right of midline.

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Operation.—June 8, 1914, an ulcer was found on the upper curvature of the duodenum 0.5 cm. from the pyloric vein, about the size of a dime, marked by stellate veins and a projection of it extended down across the viscus. A posterior gastro-enterostomy was done, also an exclusion of the pyloric region made.

The foregoing three patients, operated on by cutting into the greater curvature and inverting a septum, made uneventful recoveries. One was so treated only seventeen days ago. A second is free from stomach symptoms at the expiration of fourteen and one-half months, while the third is greatly improved some seven months after operation. The method is surely simpler, cleaner, attended with less bleeding and safer than complete transverse division; still it leaves much to be desired, as far as technic is concerned.

Experience, both clinical and experimental, has demonstrated the desirability of keeping away from both curvatures if a perfectly bloodless operation is to be done. A large series of dogs have been operated on[8] in an attempt to build a septum, just proximal to the pyloric antrum, half way across the stomach, leaving a quarter free at the minor and at the major curvatures.

This has succeeded beyond our expectations as far as technic, safety and anatomic result are concerned; hence the method was used on the following seven patients. (The technic varied somewhat in different instances; for the sake of simplicity, however, only the one which we regard as standard is given (Figs. 5, 6, 7, 8 and 9):

Case 19.—*History.*—May 29, 1913. Mr. J. T. W., aged 53. He is very anemic and has lost weight in the past month. Blood-pressure 100. Has had indigestion for years, which is worse in spring and fall. For some weeks he has been vomiting and three weeks ago began to have violent cramps. He has vomited all food, has much constipation and been confined to bed.

Gastro-Intestinal: He has a poor appetite and the pains begin suddenly any time in the upper abdomen and localize in the stomach. These pains are accompanied by nausea

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and vomiting. Food does not seem to have any influence; vomiting and morphin relieve.

Physical: General condition and nutrition are bad. The muscles are rigid, and in the gall-bladder region is a small tender mass.

Operation.—May 30, 1913, the stomach was found low and dilated, the pyloric region being involved in a mass of adhesions to the anterior abdominal wall. The pancreas was large and hard. The gall-bladder could not be found. A posterior gastro-enterostomy was done and the pyloric one-sixth of the stomach excluded by the skewer method.

June 1, 1913: Patient in a very serious condition. Blood-pressure has dropped below 70. Blood transfusion raises pressure to 100.

June 3, 1913: Patient died of subphrenic abscess which had existed three weeks before operation, that is, chronic perforation.

Case 20.—*History.*—Sept. 17, 1913. Mr. J. P., aged 32. Began five years ago with sudden pain in upper abdomen and vomiting, lasting four or five days. Could not eat during attacks. Then followed a period of good health. From four to five months later had similar attack and several others at shorter intervals. Stools black. Blood in vomitus of last attack.

Good appetite, belches after alcoholics, pains start suddenly in epigastrium, radiate to both lumbar regions and localize in the epigastrium. These are accompanied by fever, nausea and projectile vomiting of water, bile, mucus, coffee, etc., from three to four stools daily, formed with blood and mucus.

Physical: Well-nourished but anemic, breath sour, teeth poor, heavy brown coat on tongue. Tenderness in mid epigastrium, examination otherwise normal except a right inguinal hernia.

Operation.—Sept. 17, 1914, we found in the lesser curvature, not far from the pylorus, a round indurated area the size of a half dollar fixed in position by a close firm adhesion to the head of the pancreas. There were old adhesions between the liver, pyloric antrum and pancreas. Exclusion of the pyloric one-fourth of the stomach by the skewer method and a posterior suture gastro-enterostomy were done.

June, 1914: Gained 35 pounds. Feels splendid.

Case 21.—*History.*—Oct. 24, 1913. Mr. H. P. M., aged 39. Weight, 110 pounds. Smokes to excess, causing cough and shortness of breath. Began sixteen years ago with burning pain around umbilicus, coming on about three hours after eating and lasting until vomiting or opiate gave relief. There were two periods when he was entirely free from pain, in 1911 and last March lasting few weeks. The attacks are becoming more frequent.

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Has lost ten pounds in nine months. His appetite is variable. Has had irregular pyrosis for past nine months. Is bloated and has a feeling of fulness. The pains start suddenly in the epigastrium about three and one-half hours after eating and pass off suddenly. The influence of food is variable. Induced vomiting from three to four hours after eating gives relief. Rests best on the left side.

Bowels regular. Occult blood, positive.

Roentgenoscopy shows deep peristaltic waves with the antrum well filled. Position moderately low.

Wassermann: Faintly positive.

Operation.—Nov. 5, 1913, we removed a very long appendix which was completely retroperitoneal and tied down in the right fossa. The pylorus, anteriorally, showed a thick white scar about the size of a dime which firm adhesions an inch in length connected to the under surface of the liver. The gall-bladder contained nothing, so a posterior gastro-enterostomy was done and the pyloric one-fourth was excluded.

June, 1914: Gained 13 pounds. Feels perfectly well.

Case 22.—*History.*—Nov. 19, 1913. Miss V. R., aged 34. Was never strong, lost 30 pounds in past year. Has headache, roaring in ears and a tickling cough. Eight months ago, began to have soreness and heaviness in upper abdomen, worse at once after eating but also present on empty stomach. No acute attacks, no fever or vomiting. Progressive weakness and anorexia. Weight, 120 pounds.

Appetite poor for nine months. Has pyrosis one-half hour after eating which lasts only a few minutes, is relieved by belching and has slight regurgitation of bitter acid. The pains begin slowly any time in the upper abdomen and liver region which at times radiate deep in the back and never entirely disappear.

Bowels: Constipated; no occult blood.

Operation.—Nov. 21, 1913, the gall-bladder and duodenum were found tightly adherent together, the former being attached to the anterior abdominal wall. The stomach was large, the pylorus wide open; nothing could be seen of an ulcer, but on account of stomach specialist's positive statement, we did an exclusion of the pyloric one-fourth and a posterior gastro-enterostomy.

Ten days after operation, stomach contents appeared in the abdominal wound and she died of exhaustion forty-one days later, after an attempt to repair the damage.

Necropsy.—Jan. 10, 1914: Partition extending almost entirely across the axis of the stomach cavity at the right angles to it and dividing the viscus into two pouches, the pyloric one being one-sixth as large as the other. At the minor curvature the tip of one finger can be introduced into a communication between the two pouches. The septum is lined with intact mucous membrane and there are no

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adhesions to the exterior of the stomach. There is necrosis at the point of the gastro-enterostomy; through this the contents leak into the wound and peritoneal cavity, giving rise to a purulent peritonitis.

CASE 23.—*History.*—March 27, 1914. Miss A. B., aged 23. Fair appetite, eats only light diet, pyrosis after meals lasting one-half hour. She is bloated, feels full, belches after meals without relief. Has continuous dull ache which begins gradually at the right costal margin, localizes in the gall-bladder region, is worse after eating. She is nauseated and vomits spontaneously; food taken especially after the evening meal and vomiting relieve her.

Gastric Analysis: Free hydrochloric acid 40, total acidity 60. Occult blood, positive. Bowels constipated, occult blood positive.

January 16: Appendix removed without relief of symptoms.

Physical Examination: Right side rigid, stomach dilated, gall-bladder region suspicious.

Roentgenoscopy: Hyperperistalsis of stomach marked. Barium remains in stomach after six and one-half hours. The stomach is long and sags with no barium going through pylorus. Transverse colon ptotic.

Operation.—April 7, 1914: Stomach and duodenum dilated. Pylorus wide open. There was a peritoneal band extending from the minor curvature of the pylorus down and to the right. At the insertion of this band there was thickened area, the size of a nickel, on the posterior wall of the duodenum very near the pylorus; hence we did a posterior gastro-enterostomy as well as an exclusion.

June, 1914: Gaining in weight and improving steadily.

CASE 24.—*History.*—April 14, 1914. Mr. F. R., aged 23, has lost 19 pounds in thirty-six months, is nervous and does not sleep well. Weight 127 pounds.

Has had constipation for seven or eight years which began with pain low in mid abdomen; none last three years. No natural movement and must have one daily or has great discomfort from gas, etc. Appetite is fair, belches after meals. He is bloated, feels full, has regurgitation at times. Has bad pain below umbilicus which begins and passes off slowly. Food has no influence. Has nausea.

Gastric Analysis: Free hydrochloric acid 70, total acidity 92; occult blood and mucus present.

Roentgenoscopy: Ill-marked pyloric antrum, pylorus wide open, stomach normal in position and size. Empties in one hour, colon distended with bismuth and normal position.

Operation.—April 24, 1914, we exposed a stomach of moderate size considerably thickened and with a tight pylorus. The peritoneum was injected. From a point just below the pylorus on the minor curvature, there was a scar extending up to under surface of the liver and inside the duodenum;

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at this point was an area the size of a dime so thickened that it felt like cartilage; on the minor curvature, near the pylorus were a number of hard glands varying in size from a pea to a hazelnut. We did an exclusion of the pyloric antrum and a posterior suture gastro-enterostomy.

June, 1914. Steadily improving.

CASE 25.—*History.*—June 1, 1914. S. L., aged 38. Very poor health, has been losing weight and now weighs 115 pounds. Has frontal headaches. Never strong. Fell ten years ago, some abdominal trouble since. Backache and stomach trouble, feels as if eating would help. Four years ago bleeding piles appeared, free of them about three years.

Gastro-Intestinal: Appetite fair at times, pyrosis after meals sometimes lasts several hours, has choking sensations, belches bitter acid which gives some relief. Sharp, cutting pains localize in the epigastrium and passes off gradually. Nothing relieves, food influence varies. Bowels constipated. Bleeding hemorrhoids very troublesome.

Physical: Right abdomen full, narrow costal angle, tender below umbilicus, tone of muscles increased.

Operation.—June 5, 1914: There was a spastic closure of the pylorus and a duodenal ulcer on the lower curvature posteriorly very close to the pyloric ring. A posterior gastro-enterostomy was done after which the pyloric antrum was excluded.

This method of making a septum has seemed in these seven experiences to be easier, cleaner and drier than any other cutting procedure known to me. In no instance has a leak occurred at the site of obstruction. One patient died four days after operation from exhaustion consequent on a long-standing subphrenic abscess. Another died fifty-one days after operation from what may have been a perforated jejunal ulcer. In both instances the septum was almost complete (there being a small mucosa lined canal at either curvature) with no evidence of any complication about it. Of the five who are alive, two are known, as result of fluoroscopic examination, to be completely obstructed seven months and two months, respectively, after operation. Of the five last mentioned, one was operated on only twenty days ago, another is greatly improved at the expiration of two months and eight days, while the other three are free from stomach

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symptoms at nine months, seven months and two months, respectively. There is no denying the theoretical objection that mucosa is interposed between layers which are expected to heal together; still I have used it on fifteen dogs[8] and seven human subjects without a leak developing.

Two patients made rapid and satisfactory recoveries after exclusion by a strip of fascia after the Wilms method; it is, however, too early to draw conclusions. One of them is improved at the expiration of two and one-half months, while the other is free of stomach symptoms for the first time in years, twenty-four days after his operation. Details are omitted since there was nothing original about them.

Ligation of the pylorus with a strip of fascia as devised by Wilms is a simple procedure on the normal dog. I found it, however, anything but easy to apply on one human subject. There was much thickening of the tissues behind the pylorus so that it was only with great difficulty that a forceps could be introduced. A large blood vessel was ruptured by the instrument, to say nothing of time lost and difficulty encountered in ligating the same. It is much easier to exclude the pyloric antrum than to ligate the pylorus with fascia. Further considerations of importance are difficult wound closure if the fascia comes from an edge of the laparotomy incision, or the making and closing of a second incision if fascia lata be used.

My animal experimentation, tending to show whether or not obstruction produced in this manner be permanent, is still incomplete.

The exception taken to the exclusion method of Doyen[1] and von Eiselsberg,[2] tried out by Haberer,[4] Jonnesco,[5] Jianu,[6] Girard,[7] Leriche,[7] Bressot,[7] Gross-

4. Haberer: Arch. f. klin. Chir., 1913, c, No. 1.
5. Jonnesco: Revue. de Chir., 1907.
6. Jianu: Wien. klin. Wchnschr., 1910, xxiii, 1223. Girard: Verhandl. d. Deutsch. Gesellsch. f. Chir., Berlin, 1911, xl, 268. Leriche and Bressot: Lyon Chir., October, 1911. Leriche: Lyon Chir., 1913. Jianu and Grossman: Arch. f. Verdauungskr., April, 1910, xvi, 147.
7. See Footnote 6.

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man,[7] and Küttner,[8] is the difficulty of execution and the increased percentage of mortality.

Kolb,[9] Bircher,[10] Hercher,[11] Hoffmann,[12] and Göbell[13] have tried out the Wilms[14] method with the strip of living tissue, and Naselli,[15] using various tissues in six experiments, found the closure only temporary.

Brewer[16] excluded the pylorus in nine dog experiments with an aluminum strip, finding the lumen nonpatent at necropsy not later than two months and ten days.

Berg,[17] Pool,[18] Momburg,[19] Corner,[20] Renton,[21] Ward[22] and Parlavecchia[23] have used a non-elastic ligature to occlude the pylorus, and report good results; but the large majority of men who have experimented with this method find that the ligatures rapidly cut through into the lumen and are passed along with the intestinal contents.

Infolding or kinking methods as practiced by Blad,[24] Mertens,[25] Sequinot[26] and Mariani[27] give only a temporary occlusion of the pylorus.

Not a few workers in this field seem to be convinced that the best technic is that which temporarily closes up the pylorus, thus permitting the lesion to heal while allowing the pylorus to become permeable after all danger of irritation of the ulcer is past.

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8. Küttner: Deutsch. chir. Kongr., 1913.
9. Kolb: Deutsch chir. Kongr., 1913.
10. Bircher: Zentralbl. f. Chir., October, 1913, No. 40, p. 1547.
11. Hercher: Zentralbl. f. Chir., November, 1913, No. 44, p. 1707.
12. Hoffmann: Zentralbl. f. Chir., August, 1913, No. 40, p. 1331.
13. Göbell: Zentralbl. f. Chir., August, 1913, No. 40, p. 1332.
14. Wilms: Deutsch. med. Wchnschr., 1912, xxxviii, 101.
15. Naselli: La Clinica Chirurgica, May, 1913.
16. Brewer: Surg., Gynec. and Obst., 1914, xviii, 145.
17. Berg, A. A.: The Influence of Gastro-Enterostomy on Gastric and Duodenal Ulcers, THE JOURNAL A. M. A., March 22, 1913, p. 881.
18. Pool: Ann. Surg., 1913, lviii, 663.
19. Momburg: Zentralbl. f. Chir., 1913, No. 42.
20. Corner: Lancet, London, 1913.
21. Renton: Brit. Med. Jour., April, 1912.
22. Ward: Lancet, London, July 7, 1906.
23. Parlavecchia: Policlinico, Rome, April, 1910, xvii.
24. Blad: Ugesk. f. Laeger, 1912, xxv.
25. Mertens: Zentralbl. f. Chir., 1913, No. 40, p. 1545.
26. Sequinot: Thèse de Paris, January, 1913.
27. Mariani: Zentralbl. f. Chir., 1913, No. 44, p. 1706.

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I have seen W. J. Mayo and Mr. Moynihan infold with a purse-string, ulcers of the duodenum. Both seemed of the opinion that in this way temporary obstruction was produced and the value of the gastro-enterostomy enhanced. No theoretical deduction can be lightly weighed in the balance against any statement based on the practical results of two surgeons whose experience has been so rich and whose powers of logical deduction have proved so valuable.

A study of the intricate physiologic arrangement which exists for taking care of the acid stomach contents inclines one to preserve the same in the absence of weighty reasons to the contrary.

Apparently the stomach contents are sharply divided for a long time into two parts. Unacidified salivary digestion may go on two hours in the cardiac half according to Pawlow.[28]

The anatomic ground for this was suggested by Klemensiewicz,[29] who was the first to attempt isolation of the pyloric and fundus pouches, to get two pure secretions. In 1875 he excluded (bilaterally) a pylorus sack in the dog and withdrew an alkaline secretion. He kept no dog more than seventy-two hours. Heidenheim[30] kept one of six operated on thus for six months and got the same alkaline fluid with pepsin and rennin. He[31] found that pyloric secretion had no effect on the wall about the fistula. Not satisfied with this knowledge, he[32] isolated a fundus sack in eight dogs, kept one several weeks and withdrew a secretion containing pepsin and hydrochloric acid of higher concentration than the normal from a whole stomach (mixed with saliva and alkaline pyloric juice). It digested the tissues about his fistula.

28. Pawlow: The Work of the Digestive Glands, London, 1910.
29. Klemensiewicz: Sitzgsber. d. Wiener acad., March 18, 1875.
30. Heidenheim: Arch. f. d. ges. Physiol. (Pflüger's) viii, 169.
31. Heidenheim: Hermann's Handbuch der Physiologie, Leipsic, 1881.
32. Heidenheim: Arch. f. d. ges. Physiol. (Pflüger's), xix, 148.

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Sick[33] withdrew through the tube, separately, the contents from fundus and pyloric portions. He found the two samples (in healthy stomachs) to be quite different, physically and chemically. He got no or little hydrochloric acid from the pyloric portion, but obtained pepsin and rennin from it, though perhaps not so much as from the fundus.

In view of this knowledge, we must consider the pyloric antrum (as far as its secretion is concerned) as part of the intestine. Now many unfortunate experiences have proved that secondary jejunal ulcers are commoner, the lower, stomach contents are dumped into the bowel by gastro-enterostomy. In other words, the farther we go from the mucosa, in which acid secretion originates, the less automatic protection we find against its immediate effects.

We find far the greater part of all ulcers in the pyloric antrum and upper duodenum, regions which produce no acid, but which are regularly and frequently exposed to its action.

Cohnheim,[34] using from 6 to 8 cm. water, finds steady pressure on the contents of the fundus, while in the pyloric antrum, regular, powerful, peristaltic waves run along at regular intervals (six to the minute) according to Cannon[35] toward the pylorus and inject the food far into the duodenum.

Pawlow[28] agrees with Cannon[35] that it is the acid in the duodenum which causes the pylorus to close and the gradual alkalinization of the duodenal contents to a given point which causes this sphincter to open again. One must, in view of such reasoning, hesitate *especially in the presence of high acidity* before permanently dumping stomach contents onto a mucous surface ill-prepared to receive the same.

33. Sick: Deutsch. Arch. f. klin. Med., lxxxviii, 169.
34. Cohnheim, Nagel: Handbuch der Physiologie, Braunschweig, Ger. 1905-1909, Vol. II.
35. Cannon: Mechanical Factors of Digestion, London and New York, 1911.

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CONCLUSIONS

1. Our real knowledge of ulcer is so meager at present that we are not prepared to deal with remedial conditions which do more than temporarily relieve the anatomic condition which is the expression rather than the origin of this disease. In the duodenum infolding (temporary obstruction) and gastro-enterostomy accomplish this without forever diverting stomach contents to a mucosa ill prepared to receive it. This is shown by a study of the enormous material of the Mayos and Moynihan.

2. Closure of the pylorus itself cannot protect a gastric ulcer proximal to it, even in the presence of gastro-enterostomy, since the pyloric antrum drives stomach contents as far as possible toward the closed pylorus before letting it fall into the new opening. *Gastro-enterostomy alone* seems to have done less good the farther from the pylorus a stomach lesion has been found. However, my experience with unilateral exclusion of the affected area in such cases has been most satisfactory.

It takes the place of excision of gastric ulcer, or pylorectomy where the latter presents extreme technical difficulties.

A large ulcer perforating deeply into the structure of the pancreas, liver or other organs is most simply treated by exclusion.

It prevents the gastric contents passing over an ulcer; stops pain, prevents hemorrhage and puts the excluded portion at rest, allowing the ulcer to heal, thus decreasing the likelihood of secondary cancer.

3. Any form of exclusion of the pyloric antrum which prevents food passing over it accomplishes as much as does complete transverse division of the organ. Cohnheim teaches that the innervation of the stomach and pyloric musculatures is chiefly governed by automatic centers in the organ. This much is known although the exact action of the stomach's

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nerve mechanism is not understood. We cannot hope to stop secretion in the pyloric antrum by complete transverse division of the organ since Pawlow has shown that foods stimulate gastric secretion after the stomach is completely isolated from nerve connections, and hence through intrinsic ganglion by reflex nervous origin.

4. Both the methods I am proposing are simpler, take less time and encounter fewer blood-vessels than does transverse complete division of the organ. Experimentally they produced results similar to it, while clinically they seem to have been equally successful.

5. My first method (Figs. 1 to 4, inclusive) may seem the more convincing on theoretical grounds. The second (Figs. 5 to 9, inclusive) is the easier to perform and is less bloody, but it violates the time-honored principle that mucous surfaces are not to be approximated. The two methods seem to have given equally good results in experimental work; the same seems to be the case in my clinical work, although this is not so easily ascertained. I leave the reader to choose between the two, after trying them.

400 Metropolitan Building.

ABSTRACT OF DISCUSSION

DR. WILLIAM L. RODMAN, Philadelphia: So many methods have been proposed from time to time to exclude the pylorus that we must agree that it is questionable if they do exclude. We know that the early methods which were introduced were absolute failures. Practically all methods except within recent years were looked on as failures, beneficial only for a time. So von Eiselsberg devised the radical procedure of cutting across the pylorus, sewing up the pyloric and the duodenal ends, thus making the two openings in the gastro-intestinal tract to close. I am satisfied that the method described by Dr. Bartlett is excellent and, moreover, less mortality would follow his method than that of many others, and yet, he has had two deaths. The cases are too few, the time too short to say what the ultimate results will be, but I am inclined to agree with him that when the stomach

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is bound down by adhesions and a resection cannot be done, it would, perhaps, be well to use his second method. There would, I think, be less mortality than after the first. I have never performed pyloric exclusion, but if I do, shall use Dr. Bartlett's method, as it appears quicker, safer and seems to accomplish all that is accomplished by von Eiselsberg's operation. The question arises, Why operate, when, by removing a little more tissue than is removed in von Eiselsberg's operation, the ulcer-bearing area may be excluded. Dr. Bartlett's operation or any method of exclusion cannot prevent subsequent hemorrhage perforation or cancer of the stomach. There are, annually, 75,000 deaths in the United States from cancer, and more than 25,000 of them are from cancer of the stomach. Why shall we leave a lesion with so great potentialities in the stomach if it can be removed with practically the same mortality as these other methods, ingenious in a way, but which do not go to the root of the trouble? It has simply been from an exaggerated fear of the mortality. Is that justified? Recently, before the American Surgical Association, I reported a large number (375) of pylorectomies and partial gastrectomies done by American surgeons with a mortality of 4 per cent. I do not think one can do the von Eiselsberg operation with a smaller mortality and yet, in that operation, you are leaving the lesion behind. The fact stated by that great pathologist, Virchow, must be constantly kept before the mind, that 35 per cent. of all cancers in the human body are in the stomach. The time to operate on cancer of the stomach is when it is an ulcer. It has been conclusively shown that a vast preponderance of gastric carcinomas are preceded by ulcers. All precancerous lesions should be attacked radically, for in this way only shall we be doing our full duty.

Dr. W. D. Haggard, Nashville: I have not applied Dr. Bartlett's procedure to the human subject but expect to use it in suitable cases. There have been many attempts to exclude the pylorus; the old ligature has been unsatisfactory. Dr. Bartlett's operation is simple and seems worthy of trial in some cases. I would not differ with Dr. Rodman in doing partial gastrectomy in suitable cases, but the surgeons of this country ought to reserve that for the extreme case. Now it cannot be denied that an operation of that magnitude in average hands is not going to be attended by the minimum mortality of 4 per cent. that has been gathered from the great clinics of the country. This Association is to establish certain lines of procedure for the average American surgeon. While it is true that of those cases of ulcer which develop cancer, 70-odd per cent. have developed on ulcer, it does not mean that all cases of ulcer will develop into cancer. Witness the very few cases that have ever been reported of a secondary malignant degeneration of an

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ulcer that has been operated on by gastro-enterostomy or any of the other well-recognized measures. Now, if, at the time of operation, you are clinically or pathologically undecided as to whether or not the case is malignant, then Rodman's operation is the operation of election. It seems to me, however, that in the average case the principles laid down by Dr. Bartlett are the ones we should apply. Any measure that has just been introduced is, of course, going to have a hard voyage, but I do believe that if we practice this operation we shall find it applicable to a large number of patients who will do better than if we perform gastro-jejunostomy.

Dr. W. C. Jones, Chicago: What evidence does Dr. Bartlett have that his method produces complete pyloric obstruction? This point seems doubtful to me. I have been doing some experimental work with Dr. Carl Beck of Chicago, in making an artificial tube from the greater curvature of the stomach, using this tube for gastro-enterostomy instead of connecting the intestine with the unaltered stomach. In this work, the pyloric end of the stomach was narrowed as much or more than occurs in Dr. Bartlett's operation; yet we found by means of the Roentgen ray that the stomach contents passed largely through the pylorus. Passing a ligature around the pylorus did no good, as might have been expected. The most satisfactory and the simplest method we found of making the obstruction sure was complete incision of the pylorus and infolding of the cut ends. This procedure is very simple, is absolutely certain, and on the whole, leaves little to be desired.

Dr. Willard Bartlett, St. Louis: I was probably not understood when I stated that I had the stomachs from two necropsies and the stomachs of 17 or 18 dogs in evidence of the fact that the obstruction produced seems to be as complete as the operation of complete transversion with folding in of the ends. I cannot explain the difference, however, between this and Dr. Jones' method, but I shall be glad to study it.

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THROMBOSIS AND EMBOLISM, THEIR SIGNIFICANCE AND CONSEQUENCES IN ABDOMINAL AND PELVIC SURGERY

ANGUS McLEAN, M.D.
DETROIT

A condition which has been before the medical profession for many years, especially since the inception of modern surgery and modern surgical technic—a condition which is becoming more frequent with the ever-increasing number of abdominal and pelvic operations—a condition about which much has been written but concerning which little is known definitely, is the subject I wish to bring to the attention of this Section to-day. I refer to thrombosis and embolism.

The importance of this subject is at once apparent when we consider the great rôle played by thrombosis and embolism in raising the mortality in our surgical cases. Besides the mortality, the morbidity caused by these conditions is no small matter. Many are the cases of pulmonary, renal, and hepatic abscesses, not infrequent the cases of gangrene of extremities, necessitating amputation, that had their origin in thrombotic or embolic processes. Arteriosclerosis, a disease that in the course of time has been attributed to many different causes, is now looked on by many as originally due to embolic occlusions of many of the smaller vasa vasorum is really the beginning of the arteriosclerosis. How does syphilis cause arteriosclerosis? The *Spirochaetae pallidae,* circulating in the blood, become lodged in the smallest branches of the arteries. Their lodgment in the smallest ramifications of the vasavasorum is really the beginning of the arterio-

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sclerotic process. Likewise the other chronic low-grade infections often result in the same terminal process. These conditions do not, however, concern us now. In this paper I wish to consider, more especially, postoperative venous thrombosis and its probable resulting embolism.

Several etiologic factors are usually given as necessary for the formation of a thrombus: (1) trauma, especially injury to the endothelial lining; (2) stagnation or slowing of the blood-stream; (3) infection, and (4) chemical changes in the blood itself. Regarding these causes it is hardly necessary to say that not one is alone sufficient to produce a thrombus. When a thrombus does occur it is usually due to various combinations of these causes acting together. Again thrombosis often occurs, as, for instance, a femoral thrombosis that follows a surgically clean appendectomy, when, as far as we can ascertain, each one of these factors is wanting. We are therefore forced to look for some other etiologic factor in such cases. With the hope of finding some explanation for the thrombotic process in these cases, we† undertook some experiments on dogs.

EXPERIMENTAL WORK

Experimentally, thrombosis is a difficult subject to work with, first, because of the difficulties that confront us in blood-vessel surgery generally and in the post-mortem findings in particular (as for instance locating the point of lodgment of an embolus) and, secondly, because the conditions under which thrombosis and embolus occur in the human being are difficult and practically impossible to imitate. At the outset we will say that we were unable to find any reason for their occurrence. We were, however, much impressed with the tremendous amount of injury a vein can withstand without the production of a thrombus at the site of the injury. Indeed, it is quite a diffi-

† Drs. R. C. Andries, W. D. Barrett and myself.

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cult problem to produce a thrombus experimentally. In daily surgical work, all of us avoid injuring blood-vessels as much as possible. We always fear the possibility of causing a thrombus to develop.

In our experiments we noticed several interesting phenomena:

1. When a vein is ligated in continuity the blood in the vein will clot only on one side of the point of ligation, that is, the side from which the blood is coming.

2. In ligating of a vein between two ligatures (say 2 inches apart) the blood between the ligatures clots very slowly and then only if the endothelial lining is injured, and if left for a week or more the contents of the ligated vein will have entirely disappeared, a fibrous cord-like structure alone remaining.

3. Simple crushing of a vein will not cause a clot at the point of crushing. The crushing can be repeated in forty-eight hours and a clot will not form at the site. Examination of the repeatedly crushed vein two weeks after the last crushing will show a thickening of all the coats of the vein due to an increased amount of fibrous tissue, the intima remaining as smooth and glistening as before.

4. Crushing of a vein with the subsequent introduction of a twenty-four-hour bouillon culture of staphylococci and again crushing the vein to grind (as it were) the staphylococci into the walls of the vein, will not produce a clot or thrombus at the site of the crushing and injection of the staphylococci.

5. The introduction of a sterile thread into the lumen of a vein, allowing about one half to three quarters of an inch to remain suspended inside of the vein, that is, oscillating in the blood-stream, failed to produce a clot or thrombus either at the point of the introduction of the thread or around the thread itself.

6. The introduction of a thread infected with *Staphylococcus albus* or *aureus* will in three or four days cause the formation of a thrombus at the point

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of the introduction of the infected thread. The thrombus becomes attached to the vein at the point where the infected thread enters. It will not entirely occlude the lumen of the vein; it will grow or enlarge in the direction of the blood-stream, remaining suspended at a single point. (See illustration.)

On examination of an induced thrombus of this kind it can readily be seen how easily such a thrombus could be torn from its small frail attachment, circulate in the blood-stream and become lodged somewhere in the pulmonary circulation and perhaps produce a fatal termination. In our experiments we were never fortunate enough to encounter such a termination. If such a thrombus did become detached in whole or in part, it lodged in a locality which had an abundance of collateral circulation and therefore passed unnoticed.

It is difficult to conceive a condition in a patient similar to the one in which we were able to produce a thrombus in the dog; but the difficulty found in producing a thrombus experimentally shows that there must be factors other than injury to the vessel, slowing of the blood-stream and infection that bring about a thrombotic process in human beings.

In necrosis, substances are produced which cause coagulation in the blood-serum which comes in contact with the necrotic tissue. Whether these substances first cause a hemolysis, a conglutination of the platelets and red corpuscles—a view usually held in regard to the method of thrombus formation—or whether these are substances akin to fibrinogen, and thus directly cause the coagulation of blood in the vessels, is not known. Is it perhaps possible that, when thrombosis occurs after a surgically clean operation, during the operation, certain ligatures have been placed in such a way as entirely to cut off the blood-supply to certain areas, which subsequently become necrotic and liberate the substances necessary to complete the coagulation of blood in the surrounding vessels?

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RELATION OF THROMBOSIS AND EMBOLISM TO OPERATION

In looking up the statistics we find that thrombosis and embolism follow operations for large pelvic tumors more frequently than any other operations. Of forty-eight reports of cases collected by Schenck[1] 58 per cent. followed operations for the removal of large pelvic tumors. Schenck[2] also shows that in 3204 myoma operations from twelve different clinics namely, those of Goldman, Burnham, Wenczel, Duvergey, Hofmeir, Klein, Zurhelle, and Kelly, ninety-six, or 3 per cent., were followed by thrombosis. My own records of the last two years show that in 1310 laparotomies there were twenty-six cases, or about 1.9 per cent., that were followed by thrombosis or embolism. There were eight cases of fatal embolism, three cases of pulmonary embolus in which the patients recovered without further trouble, two cases of pulmonary embolus followed by lung abscess with recovery and one case of embolus of the liver followed by an hepatic abscess with recovery. Besides these cases of embolism there were twelve cases of femoral thrombosis all of which followed pelvic operations. Of the fourteen cases of embolism, eight, or 57 per cent., followed prostatectomies and hysterectomies. The striking thing in all cases of embolism and thrombosis in our series is that there was only one case of embolism with recovery and no cases at all of thrombosis that followed operations in the upper abdomen. This one case followed an operation for suppurative gall-bladder disease. In the cases that are most frequently followed by thrombosis and embolism there is always a certain amount of pressure exerted on surrounding structures. The circulation, especially the venous circulation, is retarded and extensive varicosities are quite common. There is also ample opportunity in these cases for remnants of tissue remaining,

1. Schenck: New York Med. Jour., Sept. 6, 1902.
2. Schenck: Tr. Am. Gyn. Soc., 1913.

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either in the form of devitalized pedicles or, as in the case of prostatectomy, shreds of connective tissue, which subsequently become necrotic and give off the substances necessary for the development of a thrombus.

Perhaps the most striking proof of the theory that necrotic tissue does cause thrombosis is presented in those cases of pyosalpinx in which the whole fallopian tube is adherent and necrotic and can be removed entirely without ligating a single vessel. Similarly a necrotic appendix can be removed without ligating the appendiceal artery. Here ligation is not necessary because all the veins and arteries are already thrombosed from being in proximity to the necrotic tissue. The bleeding that does occur in these cases is simply an oozing from the newly formed capillaries that have developed in the adhesions.

We know that thrombosis is more apt to follow septic cases than aseptic ones. This can be readily explained. If the necrotic area is large it is difficult to imagine how it could remain free from infection even if it is an infection of such low virulence as to escape clinical detection. If therefore to the process of simple necrosis we add an infectious one, then we really have another factor for the production of a thrombus. We have an infectious condition, coincident with which there is always an inflammation and in the first stages of inflammation a slowing of the blood-stream is noticeable. If slowing of the blood-stream, inflammation and infection are at all contributory to the formation of a thrombus—and I believe they are—then the presence of all these factors, acting together with necrosis, ought to give us the greatest percentage of cases that are followed by thrombosis. This is exactly what happens clinically.

Thrombosis and its consequent embolism rarely occurs before the eighth day. The usual time is from the eighth to the twenty-first day. Recently a case came to my notice in which a fatal embolism occurred

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as late as two months after an operation for a uterine myoma. This is a rather slow process, but complete necrosis of the tissue, on which thrombosis to a great extent depends, is not a rapid process. It usually takes a week or ten days, about the length of time in which thrombosis usually appears. The thrombus that forms during this time may remain undisturbed almost indefinitely and again, at almost any time it may become dislodged wholly or in part, and give rise to an embolus. This explains why the time of appearance of a thrombus is earlier and more constant as compared to the late and quite inconstant appearance of an embolus.

The great majority of postoperative thromboses, except perhaps those which occur after mastoid or sinus disease—and these occur in the internal jugular vein—are found in the femoral or external iliac veins. In discussing the cause for the comparative frequency of femoral and iliac thrombosis, Clark[3] came to the conclusion that it is due to the effect of traumatism exerted on the deep epigastric vein. The primary thrombosis originates in the deep epigastric vein and is slowly propagated along the line of that vessel until it reaches the external iliac vein, where it gives rise to a retrogressive thrombosis in the femoral vein. The long interval between the operation and the appearance of the femoral thrombosis suggests a slow process starting some distance away. It can be seen how a thrombus, once established in the deep epigastric vein, can be propagated to the femoral vein; but that simple trauma by retractors or the like should start a thrombotic process in the deep epigastric veins seems rather improbable, on the grounds that the most severe injury can be inflicted on veins without causing a thrombosis.

Can the formation of thrombosis and subsequent embolism be prevented? As long as we are unable to say exactly on what factors thrombosis depends, so

3. Clark: Univ. Penna. Med. Bull., July, 1902.

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long shall we be unable to say definitely, whether or not we can prevent their formation. The probable causes as they present themselves to-day should of course be avoided. It is not possible to do this at all times. We cannot always avoid necrosis of tissue nor can we always avoid infections, for infections are often present before the case comes to the surgeon. In fact, they are very often the condition for which the patient seeks relief. Once a thrombus has formed, however, we can to a large extent avoid the occurrence of an embolus. The limb should be elevated to encourage the venous circulation, and kept warm, wrapped in cotton and surrounded with hot-water bags. Some advocate ligation of the vein proximal to the thrombus, but this we believe impractical in most cases and of doubtful benefit. Absolute rest must, however, be insisted on as a precaution against secondary embolism. This rest must be kept up until the clot has had a chance to become thoroughly organized, a process which will usually take from three to four weeks. If after the lapse of this time the patient is fortunate enough to have escaped the formation of a fatal pulmonary embolus from his thrombus, if he has escaped the long and tedious invalidism consequent on the lodgment of an embolus, either septic or aseptic, in his liver or elsewhere, his subjective suffering and discomfort is not at an end. Thayer[4] examined a number of cases of postoperative venous thrombosis several years after their occurrence and found that, when the femoral and iliac veins were involved, the afflicted extremity was usually considerably and permanently enlarged. It presented varices often terminating in ulceration; in addition, there was marked weakness and cramps especially at night and on overexertion. Schenck[2] was able to gather the late histories (that is, four years old) of twenty-nine patients in the forty-eight cases in the Johns Hopkins series. Eight of them had symptoms

4. Thayer: Med. News, 1904, No. 2.

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for about four months and subsequently no trouble. Two had some difficulty in walking for about twelve months. Nineteen never fully recovered, being troubled with swelling and with more or less pain. On this basis he concludes that "it is fair to assume that about 65 per cent. of the patients never fully recover and that if complete restoration is to follow it will come before the end of the first year, by which time the collateral circulation is as completely established as it ever will be."

Some one has said that surgical morbidity does more to bring surgery into disrepute among the laity than surgical fatality. It is more lasting and it is continually and prominently before the people; whereas fatality is soon forgotten. If this is so, thrombosis and embolism more than any other condition should ever be in our minds as one of the possibilities that may put a practically indelible blot on even the most skilful surgery.

CONCLUSIONS

Endothelial damage, on which so much stress is usually laid, is not, *per se,* a cause of thrombosis.

Necrosis of tissue plays an important part in the production of thrombosis.

The main contributory causes are, probably, a low-grade infection, not of sufficient virulence to be noticed clinically, and slowing of the blood-stream.

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STANDARDIZATION OF SURGERY

AN ATTACK ON THE PROBLEM

ROBERT L. DICKINSON, M.D.
BROOKLYN

At one time the surgeon was almost the only skilled mechanical worker with a craft knowledge analyzed, recorded and disseminated. Now the man with the shovel and the apprentice bricklayer have outstripped him in technic, for in their activities essential motions, tools, and economy of effort have been studied and standardized and taught, while we who think ourselves open-minded scientists look askance at propositions to apply to ourselves measurements of action and efficiency and fatigue, record of errors, instructions in type, motion-training, submission to discipline and new adjustments of function and cooperation. The high average of equipment, dexterity, information, conscientious care and self-sacrificing humanity in operating-rooms, great and small, here and abroad, are matters which some years of planned travel and laborious note-taking heartily attest; but evidence is not lacking that advance is very irregular where it might be all along the line, and erratic rather than on any studied and unified plan.

Is it unfair to affirm that, on the whole, surgery is unstandardized? For example, what is standard nursing? Does Germany have an idea of American ward practice in this line? What is the standard treatment of chronic non-operative disabilities? Has America shown evidence of acquaintance with the outfit of nearly every large German hospital? What is high-grade care of the well-to-do, of the poor? Has London an inkling of the provision for private patients which is a feature of our hospitals, even in small

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towns? On the other hand, have we any understanding of their organized insurance relief among the lower classes? In surgical teaching how many countries have copied the one that gives nation-wide promotion for merit? Indeed, to make the point we do not have to select the larger issues; elementary every-day instances will do. For the simple abdominal incision where every factor may be worked out to standard, who has run a long course of tests? In stitching and tying have we settled what are the swiftest motions, as a peasant lace-maker has; or do we ever go into training for correct form? Yet piano-players, pugilists and golfers study these things. The diamond knows every player's batting average, the race-track publishes records, the government office rates men for accomplishment. But there is no hospital governing board which, when a vacancy occurs, or the day of annual reappointment comes round, can ask for the equivalent of a fielding average, or track performance, or rating for character of work done as applied to a visiting surgeon, a house surgeon or a nurse. A consensus of opinion made up of general impressions, of personal preference and prejudice decides. Who determines, anyway, whether a man is fit to operate at all? A doctor without surgical qualification may engage bed-room and operating room in one of the dozen private sanatoriums in any large city, or in the hospital of the little community, and proceed to do the gravest of operations. Until now the patient has had no way of knowing whether or not the doctor has had surgical training. There is no graded standard at all. That the public does not want to be protected and would hinder standardization and legislate for "medical freedom" hardly lessens the duty to lay bare the facts and to present some plan for betterment. We may first, however, get some notions of what that plan might be and set them down. For we would not like to admit the extent of our ignorance, all the way from the specific requirements as to just what is the best mate-

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rial for a knife-blade, or the best way to sterilize it, up to the number and kind of hospitals needed in a particular type of community.

A beginning has been made. What has been done in Germany is ably recorded in Grober's book. Our hospital superintendents have one of the most practical and effective organizations in the country. A group of independent New York hospitals is working together in several matters, such as purchasing, issuing reports, checking up of the end-results of each surgeon's work, and promotion for merit rather than for seniority. Dr. W. G. Thompson of New York has shown the unnecessary number of miles of walking done by ward nurses because of poor room planning. Philadelphia has a Committee on Hospital Efficiency named by its County Medical Society to study the whole situation there with an efficiency engineer, Mr. Richard Waterman, as its secretary. Each of the fifty-five hospitals of the city has been invited to send to a conference an "efficiency committee" made up of the superintendent, a member of the lay governing board, and a member of the professional staff. There questions of uniform accounting, cooperative social service and studies of end-results are taken up. The reports are to be had from Dr. Edward Martin, 1506 Locust Street. The New York Board of Estimate has published pamphlets covering investigations by Mr. Henry Wright concerning Bellevue and Allied Hospitals, and has recast the organization. A beginning in the coordination and standardization of dispensary work has been made for the clinics of New York (and also of Brooklyn) by the Associated Out-Patient Clinics of the City of New York, with an office at 17 West Forty-Third Street. Groups of picked men of allied interests have found that at a cost of a couple of thousand dollars within the space of five years and by a very moderate alteration or enlargement of ordinary vacations they can see the best clinics of Europe and America at work and thus select the best experience.

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Surgical literature is abstracted in a way more nearly approaching symmetry and completeness than ever before in the joint American-German-French publication the *International Abstract of Surgery*. Furthermore, the degree of the American College of Surgeons will set a new standard here so that the public will understand what qualifications are fundamental. And, lastly, there is a demand for the standardization of hospitals that cannot fail to bring about far-reaching results.

A GENERAL PLAN

A scheme or proposal for standardization of hospitals and surgical technic and procedure and surgical outfits would be worthy of wide and concerted effort. How should it be attacked? I have tried to find out. Dr. Hornsby answers that the organization of hospital superintendents shows that they are fully awake to the need and have made great advances on the administrative side. The father of the newer studies of efficiency in industry, Dr. Frederick W. Taylor, who has praised operative work as an example of well-planned procedure, writes me as follows:

> In applying the principles of scientific management to hospitals I am sure there is an immense field . . . the best progress can be made if the work is done under the guidance of a man who has had practical experience in changing over from the old to the new type of management. . . . Unless the introduction of the new methods is made the special work of a man whose whole success depends on making quite rapid progress, the details are so great and the obstacles so many that even after a year or two of work, almost nothing seems to have been accomplished.

Then he gives warning that there are a multitude of fakers posing as efficiency engineers.

In Mr. Waterman's activities in Philadelphia, referred to above, an attack was made on the big problems in a basic fashion. That committee has not yet, I understand, reached the consideration of a plan of study of general surgical technic.

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Mr. Frank Gilbreth, while condemning our methods rather fluently has a program to suggest to us. He alone, as far as my questioning goes, has an answer to the query, yours and mine—what can I do—do now—to work out this thing in my own hospital, in my own line? This engineer has seen a considerable amount of operating in the United States and Canada and some in Europe. He has taken moving pictures of operations at New York Hospital, where he is consultant engineer, though he is, unhappily, too busy a man to be able to give much time to the institution. He asserts that hospitals are far behind factories in effective organization; that from 10 to 30 per cent. of precious ether moments could be saved, more especially in the period of preparation. "Surgeons," he says, "think not in terms of elementary motion, but in periods of elapsed time."

He outlined for me last February the way he would go about the study of our problems. He said:

The ideal way would be a demonstration hospital, but until one is started any institution could do these things: first, lay out a form for making a record; next, record the present practice in minutest detail; third, examine the data thus gained; fourth, organize a planning department, and last, adapt to your special needs the plan of carefully separated functions, with their functional foremen.

With regard to the study of detail, make stereoscopic pictures of everything. No detail is too small to write down. Trace the route of a pill from the manufacturer until it goes down the patient's throat. Make the most painstaking statement of every single item of outfit and action. A doctor should be assigned to the engineer who would do this, taking, if necessary, two years and making Century Dictionary-sized volumes.

As to the examination of the data, it is astonishing how just the laying bare of cold facts will be enough to reform and abolish no small proportion of the things that are wrong. Most institutions boggle at the proposal to make this kind of record. They are afraid of it. Most surgeons resent it, refuse it. But this is the way to better things—to chart every break in technic, stick it up, be public about it. And cure results.

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In the matter of the planning department, ask any institution for its chart. It looks foolish. It hasn't any chart. [He showed the chart of a factory organization (Chart 1) and commented on it.] This chart may be modified easily to fit the health factory. The important matter is to divide and define the functions of the various individuals, particularly of the foremen. The questions in a factory or in a hospital are these: Who? When? Where? How? Upon what man does each one of these things depend for advice and control? There would have to be some alteration to fit this class of institution. For instance, there would be no speed boss. In place of a gang boss there would be a teacher. There would be a repair man. There would be an inspector,

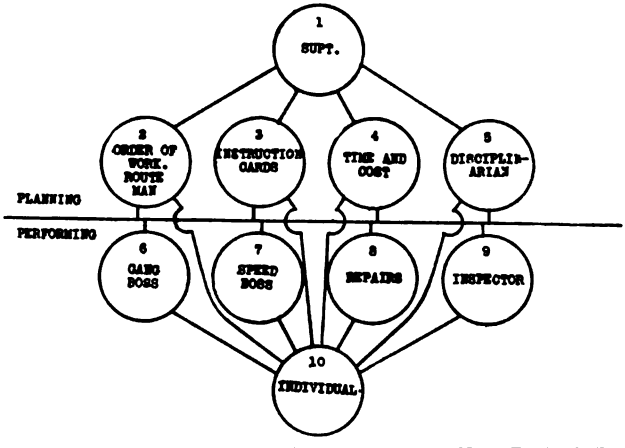

Chart 1.—Functions of scientific management, New England Butt Company, Providence, R. I., 1912.

who would be a very important part of the organization. His work would be not so much investigation as prevention. Investigation is the finding out of the cause of trouble after it happens. Inspection is the keeping of everything up to the mark so that trouble does not happen. One might be said to be post mortem, the work of the pathologist. The other might be said to be preventive medicine. This man need not be a medical man. He is the checker up and is not the man who punishes or disciplines, for when he finds something going wrong, such as a nurse dropping gauze on the floor on her way to do a dressing, or making unsafe contacts, it is he who reports to the disciplinarian. All breaks, all technical errors of whatever kind are entered by him. If a surgeon makes a fault in technic it is entered without malice and without any other idea than that of checking up. Publicity about this list of errors is the great way of stopping trouble.

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The disciplinarian is the man who decides all the questions bearing on faults made. His activity is not that of bouncer in general as the word suggests. A workman may commit several faults. Under the old régime it was three times and out. Then he was bounced and a new man put in who was allowed to make four errors and then he was bounced and went off and got another job. Under the new way when the first man has made errors—one, two, three—he is every time gently but persistently corrected and correction continues until he ceases to make that particular error.

As far as possible all activities are charted in a peak and valley drawing. The peaks and valleys give us the clue to the high and low points of all our work and we proceed on these clear indications.

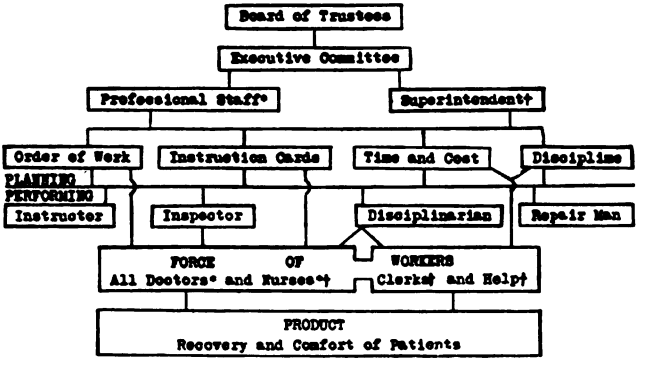

Chart 2.—Functions of scientific management in hospitals (suggested by Gilbreth, drawn by Dickinson); *=professional control; †=executive control. Alternative: Omit "Professional Staff."

Be simple. Use few tools. Imagine yourself operating out under a tree. Hunt out the best experience, measure it, make it standard, write it down on an instruction card. Above all get your people thinking in terms of elementary motions.

The merit of these suggestions by Mr. Gilbreth lies herein, that he gives us something concrete to start on. The medical practitioner is still trying to work on the old one-doctor-one-patient scheme. American practice in surgical services has no clear plan. It works on what might be called a one-surgeon-all-function idea. In large hospitals the usual arrangement is this: The visiting surgeon is responsible, in his wards, while on a three months' tour of duty, for many varying and

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ill-defined activities. He plans, teaches, inspects, executes. His ideas may vary not inconsiderably from those of his predecessor or the man who follows him, but he has neither chart nor detailed written instructions to show others what these ideas are when his trimester begins. His force is yet to be drilled. By the time it leaves him it has begun to appreciate his needs and the group is working together. Members of the house staff are frequently jealous of and openly rebellious at assistance, however skilled, given at operations by qualified older assistant visiting surgeons. Except for the one in charge, the nurses are furnished to the operating-room to be trained and are removed as soon as effective. Checking up by the visiting surgeon is sporadic, never covering all detail in the whole of his service, never overlooking an entire day's activities. Supervision of a visiting is unkown. It is not too much to say that he actually accounts in details to no one, and presents no balance sheet.

In hospitals where a surgeon's service is continuous, some system prevails. Even here, however, there is no answer to the question as to how many hours a day or a week he is required to give to this unsalaried service. Nor is tenure of office fixed. Usually it is for life. The juniors serving long years never know what prospect there is of promotion. Nor can able men not connected with the hospital determine whether opportunity or experience may be obtained in service there, as they might should a limit of fifteen years be named for such service or a Codman plan of measuring men by their results be instituted to weed out incompetents.

PLANNING DEPARTMENT

While studies looking to wide changes in organization are under way, parts of the factory scheme might be adopted, such as a planning department, instruction, inspection. As to order of work and instruction cards, rules and regulations exist in every hospital—in the

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back of some dusty drawer. Wherein are many dead letters and few directions for details of every-day procedure. Ward routine is tradition; a newcomer alters it at will; an enema is given in three or four ways. A house officer starting on service gets directions as to his duties passed along by word of mouth. A head nurse imported to take charge of the operating-room rarely finds these things: a schedule of duties and of outfit; formulas; a list of stock instruments as agreed on by the staff, each article catalogued by its name and picture (in a place where tools are very various); diagrams of the instrument table for each operation or class of operations, and typewritten details of the procedure adopted as the standard average in this particular set of operating-rooms. Yet every employee can be provided with a schedule of duties and belongings. In any hospital, in each of the sections of the planning department—order of work, instruction cards, time and cost, and discipline—the study of precedents and conditions could be taken up to-morrow and in time fairly complete schemes be submitted. This could be done by one man committees or members of the professional staff combined with the executive.

INSTRUCTION

The drill of the house surgeon cannot properly take place when explanation, question and pause are impossible—with blood spurting and seconds precious. The training in aseptic operative technic of the specialist on the eye, ear, nose and throat cannot be worked out by himself, yet there is no one whose duty it is to show him. These are but examples. High or low, every one of us needs better knowledge of standards and new methods. In no rationally planned way can this be brought about save to agree on standard and to delegate the general teaching and levelling up to some qualified individual or individuals. In the training-school we are used to this daily instruction. On the professional side it is haphazard.

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INSPECTION

It is not easy to adjust our point of view to the idea that the actions of all of us are to be checked up and compared with certain standards while our breaks are calmly tallied and bulletined and our results are openly scheduled. As it is at present a visiting or associate may be a striking success in diagnosis or technic but in other points like after-care or progress or humanity be grievously defective. Who may tell how the balance is to be struck under present methods?

SUMMARY

Pending the working out of a comprehensive plan we have outlined the progress already made in the direction of standards and coordination, and pointed out the way an individual surgeon or service may begin to try out certain of the advanced methods adopted in the management of industries. Some of these are new adjustments of "function" (responsibilities and duties) clarified, charted, defined; regular instruction, such as drill in technic and manual dexterity and correct form; practice in team work; the printing on instruction cards of the best standard practice covering all ordinary acts and activities; constant inspection by one delegated to this duty; record of successes and errors like a ball-player's fielding average or a government office tally of character of work done; promotion by rating, and finally, a series of studies, undertaken as in the other mechanical crafts, by measurement of motion, speed, fatigue and efficiency.

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THE PATHOLOGIC PHYSIOLOGY OF UTERINE BLEEDING

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The study of uterine bleeding is given a peculiar interest by the fact that the uterus is the only organ in the body from which a periodic hemorrhage occurs as a physiologic phenomenon. The logical point of departure in the investigation of pathologic uterine hemorrhage, therefore, would seem to be a study of the normal type of uterine bleeding, that is, menstruation. Even a superficial familiarity with the enormous literature of the subject, however, will convince one that the problem is rarely approached in this fundamental way. In the study of all the menstrual disorders the tendency has been to lose sight of the fact that there are many links in the menstrual chain, and to emphasize some one factor at the expense of others, which may be equally important. As regards the explanation of uterine bleeding, it is the anatomic point of view which has in recent years received most attention. This is perhaps not surprising when we consider that up to very recent times our knowledge of the menstrual process has been much more highly developed along anatomic than along physiologic lines, and that structural alterations in an organ are far easier to demonstrate than aberrations of function. More and more, however, we are beginning to realize that the uterus is only a keyboard on which many variations are played by a complicated menstrual mechanism whose ramifications extend far beyond the confines of the pelvic cavity. Not only the uterus, but all the other constituent parts of the

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menstrual apparatus as well are subject to disturbances of one form or another, and hence none of them should be overlooked in the investigation of uterine hemorrhage of obscure causation.

At the outset it may be conceded that in the majority of instances the cause of uterine bleeding is anatomic, in some cases very frankly so. For example, uterine cancer is a perfectly obvious cause of bleeding from the uterus, just as rectal cancer may cause bleeding from the bowel. The same clear relationship is seen in the case of a few other lesions, more especially those of neoplastic type. We may thus distinguish, first of all, a type of uterine hemorrhage clearly due to well-defined and easily demonstrable causes in one part or another of the uterus. There would be hemorrhage from lesions of this type even though there were no such thing as menstruation to cause a periodic flare-up in the pelvis.

A second group of cases may be distinguished in which a lesion of some sort exists either in the uterus or in the adnexa, but in which hemorrhage would probably not occur were it not for the extra congestion which each menstruation brings with it. A tubal inflammatory mass or an ovarian neoplasm might not in itself be capable of producing hemorrhage, but it frequently exaggerates the menstrual hyperemia, and hemorrhage is the result. When metrorrhagia or intermenstrual bleeding occurs, it would seem at first sight to indicate a direct effect of the lesion itself on the pelvic circulation. This, however, does not necessarily follow, for it is possible, as some have contended, that in many of these cases the disturbance of the menstrual mechanism is much more fundamental, involving the function of the ovary itself.

Finally, there is a third group of cases in which uterine hemorrhage occurs in the entire absence of any clearly demonstrable disease in any of the pelvic organs. I use the expression "clearly demonstrable"

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advisedly, for numerous efforts have been made to explain the bleeding in these cases along anatomic lines. For many years it was the endometrium which constituted the target for the diagnostic acumen of gynecologic pathologists. The work of Hitschmann and Adler,[1] confirmed by many others,[2] has done much to clarify our knowledge of the part played by the endometrium in the menstrual process. Except in certain rather exaggerated conditions, such as polypoid endometritis, it is difficult to fix on the endometrium any great measure of responsibility as a cause of uterine bleeding. Many of the supposed abnormalities of the endometrium are perhaps the results rather than the causes of the menstrual disturbances, for we are apt to forget that the hypertrophic changes of the premenstrual period represent the reaction to periodic hyperemia of a very labile tissue — and a tissue made more labile by constant repetition of the process over many years, or, from an evolutionary point of view, over many ages. Abnormalities of the menstrual phenomenon, either in rhythm or in intensity, may thus be reflected in the endometrium, which plays a purely passive part in the process. Furthermore, since the endometrium is always "on edge," it may undergo hypertrophic changes as a reaction to hyperemia other than that associated with menstruation.

In view of our inability to fix the responsibility for uterine bleeding entirely on the endometrium, it is not surprising that the search for a local cause has gone deeper into the uterus. It was Scanzoni, in 1861, who first directed attention to the importance of the mesometrium in this connection. Although receiving little attention for many years, the subject has in recent years been again brought to the forefront by the work of Theilhaber[3] and others. It is not within

1. Hitschmann and Adler: Monatsch. f. Geburtsh. u. Gynäk., 1908, xxvii, 1.
2. Gardner, W. S., and Novak, Emil: The Endometrium and Some of Its Variations, THE JOURNAL A. M. A., Oct. 9, 1909, p. 1155.
3. Theilhaber: Arch f. Gynäk., 1902, lxvi, 1.

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my province to discuss the various theories which have been put forth—the "insufficientia uteri" of Theilhaber, the "metrorrhagia myopathica" of Anspach, etc. There can be little doubt that the myometrium, like the endometrium, is responsible for a certain number of cases of uterine hemorrhage, but the proportion is probably not so large as to throw any great light on the mechanism of uterine hemorrhage in general.

Even less important, to my mind, is the rôle played by disease of the blood-vessels in the production of bleeding from the uterus. Much importance is attributed to this factor by Pankow,[4] Slocum[5] and others. There are many objections to such a view, especially to the explanation which many offer that the bleeding is the result of an actual rupture of the blood-vessels — an "apoplexia uteri." This is not the place to discuss these objections — some will suggest themselves. No satisfactory proof has been advanced that arteriosclerosis or atheroma of the pelvic blood-vessels exerts more than an occasional influence in producing uterine hemorrhage.

It will thus be seen that the occurrence of uterine bleeding is not necessarily associated with anatomic findings in the uterus, which is the immediate source of the menstrual flow, or in the other pelvic organs which participate to a greater or less extent in the menstrual phenomenon. Shall we, in spite of our failure to find an anatomic explanation in many cases of uterine bleeding, still tell ourselves that it *must* be there? Or shall we make our study more comprehensive, remembering that other factors than the organs themselves are concerned in menstruation, and that abnormal uterine bleeding may perhaps be due to aberrations of these other cogs in the menstrual mechanism?

4. Pankow: Arch. f. Gynäk., 1906, lxxx, No. 2.
5. Slocum: Surg., Gynec. and Obst., April, 1908.

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What are these other links in the menstrual chain? What, first of all, is the fundamental cause of menstruation? We have for many years looked on the ovary as primarily responsible for the occurrence of menstruation. Certainly the complete removal of all ovarian tissue as a rule — some say always — causes cessation of menstruation. There is abundant proof that this function of the ovary is dependent on an internal secretion which it contributes to the blood-stream. On the other hand, many facts are known which indicate how intimately the ovarian hormone is bound up with that of many other glands in the body which produce internal secretions. There are some indeed, who maintain that, important as the ovary is to menstruation, the ovarian hormone is not the ultimate cause of the latter. According to this theory, which is suggested by so good an observer as Halban, the ovary is merely the activator of the real underlying cause, which resides in some other part of the body, most likely in some of the ductless glands. It is no longer a mere theory that the ductless glands form a functional chain throughout the body, and that disturbances of any one of them are apt to exert a far-reaching effect on other members of the group. However indispensable the function of the ovary in menstruation, an important contributory rôle must be assigned to these other organs of internal secretion. There is much evidence of a functional relationship between the ovary and the thyroid, the ovary and the hypophysis, and the ovary and the suprarenals. As regards the other ductless glands, the evidence is not quite so imposing, though many scattered facts point to more or less correlation of function in the case of almost all of them. I shall not here discuss the still disputed question as to which element or elements of the ovary produce the hormone which exerts such a profound influence on menstruation.

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How does the ovarian hormone bring about the hyperemia of menstruation? Either it acts directly on the blood-vessel walls or else it produces its effect through the vasomotor nerves. There is some reason for supporting the first of these views, although the second manner of action is more commonly found in the body. Physiologists, I believe, are prone to speak of any relay station in the spinal cord or elswhere as a "center," and from this point of view some have spoken of a so-called menstrual center, usually described as being located in the lumbar portion of the spinal cord. While there seems to be no definite knowledge concerning such a center, there is no question that the vasomotor nerves of the pelvis play an important rôle — whether essential or only supplementary we cannot say — in the production of the hyperemia which is perhaps the most conspicuous feature of menstruation. The vasomotor nerves are offshoots of the sympathetic nervous system, and through the rami communicantes are linked up with the cerebrospinal system and even with the psychic centers in the brain. The significance of these facts I shall elaborate later in my paper.

From this brief summary it may be seen that the factors concerned in menstruation are (1) an underlying cause; (2) a nervous mechanism, essentially vasomotor in nature, and (3) the uterus, and especially the endometrium. The cardinal theme of my paper is that uterine bleeding may be due to disturbance or perversion of any of these factors, and that an intelligent study of a given case must embrace a search, not for anatomic alterations alone, but for deviations from the normal physiology as well. In accordance with the foregoing views of normal menstruation, I suggest that the causes of uterine bleeding may be divided into three groups: (1) the fundamental causes, embracing disturbances of the internal secretions, either of the ovary or of some of the other

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Blutdrüsen; (2) the nervous causes, which exert their effect mainly through the agency of the vasomotor nerves, and (3) the anatomic causes, which have to do with structural alterations in the pelvic organs, pelvic blood-vessels or, for that matter, in the blood itself.

A discussion of the last group is scarcely within the province of my paper. I can only repeat that the cause of uterine bleeding is most frequently to be found in this group, which embraces such common conditions as uterine and ovarian neoplasms, adnexal inflammations, incomplete miscarriage, etc. My discussion will therefore be limited to the fundamental and nervous causes of uterine hemorrhage, both of which are admittedly less frequently observed than the anatomic group.

In the consideration of the fundamental causes of uterine bleeding, we at once find ourselves on very uncertain ground. In the enormous literature concerning the internal secretions, there is much less of fact than of fancy. When the ductless gland faddist, if you choose to call him so, blows his warm breath on the molecule of fact, it is quite apt to be vaporized into the mountain of hypothesis and speculation. And yet from this great nebula of hypothesis new facts are constantly being crystallized.

As already stated, it is with the ovary that we are primarily concerned in the consideration of menstruation and its various disturbances. The study of the ovarian hormone, like that of the other internal secretions, is much easier along negative than along positive lines. To illustrate, by mere extirpation of the ovaries we may show that cessation of menstruation is due to loss of the ovarian hormone. But it is far more difficult to bring about a condition of hyperfunction of the ovaries, nor is it even certain that such a condition of "hyperoophorism," analogous to hyperthyroidism, may be produced. In the case of the

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thyroid, mere feeding of the gland extract to a normal person suffices to bring about hyperthyroidism. On the other hand, the possibility of producing hyperoophorism by feeding ovarian extract has been questioned. This is perhaps not surprising when we consider how little we know concerning the nature and characteristics of the ovarian hormone or hormones, and how gradual and inconspicuous would probably be the effect of an excess of ovarian secretion, even though we were sure that this could be produced by mere feeding of the extract. A number of cases have been recorded in which hyperoophorism has apparently been brought about by the latter method. A rather striking case in the recent literature is that of Adler.[6] It was that of a girl of 21, who had menstruated normally since the age of 15, but who after a short course of an ovarian extract for the first time in her life menstruated four days before the expected time, the flow being much more profuse and lasting longer. After the cessation of the treatment menstruation resumed its old periodicity, duration and intensity.

Much more interesting, however, is the effort of Adler to determine the existence of hyperoophorism in an indirect manner. His method requires a word of explanation. As with the other viscera, the principal nerve-supply of the uterus is derived from the sympathetic. A very revolutionary change is now in progress as regards our ideas of the physiology of the sympathetic nervous system, or, as it is frequently called, the vegetative system. According to the classical description of Langley, the entire vegetative system may be divided into two portions. First, there is the gangliated cord which stretches along each side of the midline of the body, and which may be called the sympathetic system proper. Secondly, many of the autonomic functions of the body are in part regulated

6. Adler: Arch. f. Gynäk., 1912, xcv, 349.

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by certain cerebrospinal nerves derived principally from the brain and from the sacral portion of the spinal cord. These nerves constitute what is therefore called the craniosacral autonomic system. From the fact that the vagus nerve is the most prominent constituent, this system is also spoken of as the vagal. Kraus, again, speaks of it as the parasympathetic. The distinction between the two systems can perhaps be best illustrated by the case of the heart. This organ receives its accelerator supply from the sympathetic, its inhibitory supply from the vagus. The

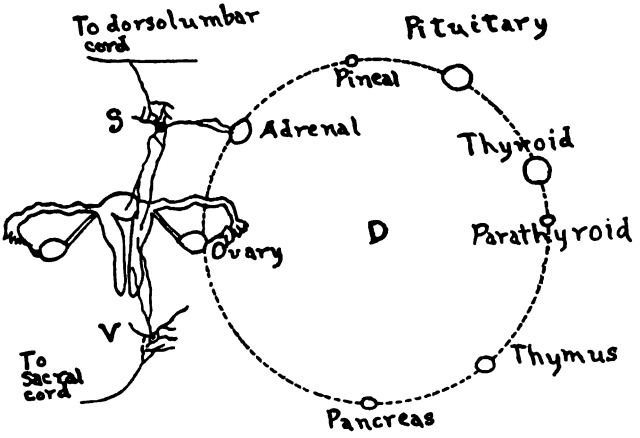

Diagram showing principal physiologic factors concerned in menstruation. *D*, the ductless gland chain, the ovary being the organ most intimately related to menstruation. *S* and *V*, the two physiologic divisions of the vegetative nerve system—the sympathetic proper and the craniosacral autonomic, respectively. Both are traceable to the cerebrospinal system, and the sympathetic is seen to be directly connected with the ductless gland chain, notably at *s*, with the adrenal.

former is the whip of the heart, the latter the brake. This antagonism in function is characteristic, being noted in all the other organs, including the uterus. To proceed to the practical application of these facts, it has been found that certain drugs show an elective affinity for one or the other of the two systems. Epinephrin, in accordance with the well-known law of Langley,[7] affects especially the sympathetic, its

7. Langley: Schaefer's Text-Book of Physiology, ii.

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injection causing precisely the same effect on an organ as does stimulation of its sympathetic nerve-supply. It is therefore spoken of as a sympathicotropic drug. On the other hand, pilocarpin is perhaps the best-known of a group of drugs which exert a special action on the vagal system, and which are therefore spoken of as vagotropic drugs. To carry the point still farther, it has been found that certain endogenous chemical substances of the body, more particularly the various hormones, exhibit a special influence on one or the other of these two systems. There is reason to believe that before very long all the various hormones of the body will be divisible into two groups, one sympathicotropic, the other vagotropic. Much has already been done along this line.

Studies on the ovarian hormone from this point of view are still very meager. The observations of Adler,[6] however, are worthy of mention. After removal of the ovaries, and to a less extent in cases of ovarian insufficiency manifesting themselves by amenorrhea and genital hypoplasia, he finds that there is an increased susceptibility to small doses of the sympathicotropic epinephrin. On the contrary, in the study of a series of cases of uterine bleeding, he observed no reaction whatsoever to epinephrin, while on the other hand there was a marked susceptibility to even very small doses of the vagotropic pilocarpin. This result he regards as justifying the view that these cases of uterine bleeding were due to overfunction of the ovary.

This conclusion, however, is open to serious question, when we consider that many structures other than the ovary contribute to the characteristic reactions. Even so, however, such work as this is of exceeding value. For perhaps the first time, we are now able to attack the hitherto rather intangible problem of the internal secretions by simple clinical methods instead of by complicated laboratory investi-

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gation. Just what practical results will accrue from this new line of endeavor remains to be seen. In the light — or shall I say the darkness? — of our present knowledge of the influence of various hormones on menstruation, the present methods of organotherapy in gynecologic disorders are largely empiric. Until we can put our figurative finger on the specific hormone or hormones at fault, there is little hope of a rational therapy of the various menstrual disorders which are now so indiscriminately treated by various organic extracts. Even before the realization of such an ideal, however, we may hope for advance through studies based on the demonstrated relation between the vegetative nerves and the internal secretions of the body, including that of the ovary. If we cannot definitely determine that uterine bleeding in a given case is due to disturbance of some specific hormone, would it not be a real advance, for example, to be able to say that it is characteristically associated with a condition of vagotony? Even therapeutic possibilities suggest themselves from work along this line.

Though as yet on a small scale, I have entered on the study of this fascinating subject, and as far as uterine bleeding is concerned, have had results in part at least similar to those of Adler. The most marked vagotonic reactions which I have noted have been in four cases of hemorrhage in girls at puberty. In all these cases, the injection of from 1/15 to 1/10 grain of the vagotonic pilocarpin gave a most pronounced reaction, characterized especially by profuse perspiration, a feeling of warmth, salivation, contraction of the pupils, etc. On the other hand, the strongest epinephrin reactions have been noted in women at the menopause. The injection of 1 mg. of epinephrin (about 15 minims of the 1 : 1,000 solution) caused pronounced tremor, nervousness, a feeling of cold or chilliness, dilatation of the pupils, rapid heart-beat, and rise of blood-pressure. It must not be supposed,

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however, that such methods will enable us to work out the problem of uterine bleeding by rule of thumb. Many apparent contradictions have occurred in my own work, some of them difficult or impossible of explanation. For details as to the theory and general method of such study, I would refer those interested to the articles of Adler,[6] Eppinger and Hess,[8] and Barker and Sladen.[9] My own results I hope to record in detail in a later paper.

Another physiologic factor in the causation of uterine hemorrhage which is closely associated with the activity of the glands of internal secretion has reference to the presence of some local factor in the endometrium which is capable of diminishing the coagulability of the blood and thus predisposing to bleeding. Sturmdorf[10] has suggested that the endometrium, under the influence of the ovarian hormone, manufactures a substance which inhibits the normal coagulability of the blood. The experimental work of Schickele[11] and others has led to somewhat similar conclusions. Schickele's results are based on the study of the inhibiting influence of extracts and expressed juices of the uterus and ovaries on the coagulability of the blood. When there was abnormal bleeding from the uterus, he found that the inhibitory powers of the ovarian extracts are greater than those of the uterus; but when profuse menstrual bleeding was present, it was found that the extracts from the uterus exerted a much greater inhibiting effect on coagulation. This would seem to indicate that bleeding is associated with the accumulation of coagulation-inhibiting substances in the endometrium. Without going into greater detail, I need only say that the work of Schickele indicates that the inhibiting substances are formed in the ovaries and given off in the uterus.

8. Eppinger and Hess: Die Vagotonie, Samml. klin. Abhandl. über Path. u. Therap. des Stoffwechsels, Berlin, 1910.
9. Barker and Sladen: Tr. Assn. Am. Phys., 1912, xxvii, 471.
10. Sturmdorf: New York State Jour. Med., 1911, xi, 460.
11. Schickele: Arch. f. Gynäk., 1912, xcvii, 409.

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When uterine bleeding is present, there is an excessive amount of these inhibiting substances in the uterus. Schickele suggests that this is probably due to overactivity of the ovary, so that ultimately this local physiologic factor in the causation of the bleeding is apparently traceable to a fundamental disturbance in the mechanism of the menstrual process. The occasional success of the operation of curettage in the relief of uterine hemorrhage, even when the endometrium is anatomically normal, may perhaps be explained on the basis of this work, the good result being due to the removal of the inhibiting substance rather than of the endometrium.

As to the dependence of uterine bleeding on disturbance of other internal secretions than that of the ovary, I can only mention the possibilities, accurate observations still being very meager. That a functional relationship exists between the generative organs and the thyroid gland is now a well-established fact. The swelling of the thyroid at menstruation and during pregnancy, and the occasional occurrence of even acute hyperthyroidism after removal of the ovaries, are manifestations of this physiologic correlation. While observations are not unanimous on this point, it seems to be true that hyperthyroidism frequently includes among its other symptoms menorrhagia or metrorrhagia, while hypothyroidism, on the other hand, is more commonly associated with the occurrence of amenorrhea or scanty menstruation. These conclusions are based on the study of outspoken cases of deficient or excessive thyroid secretion, as the case may be. When one considers the frequency of minor grades of thyroid disturbance, and how often they are overlooked, it is easy to appreciate that a certain proportion of cases of uterine bleeding may be thyroid in origin.

Concerning the possible influence of other ductless glands, we can say even less of a definite nature. That

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the pituitary exerts an influence on menstruation is illustrated in the well-recognized adiposogenital dystrophy of Frölich, due to pituitary deficiency and characterized clinically, among other symptoms, by amenorrhea or scanty menstruation. This being true, one is tempted to believe that the opposite condition, menorrhagia, is perhaps sometimes due to hyperpituitarism. Of this, however, there is no direct proof, and as a matter of fact, many cases of hyperpituitarism appear to be associated with amenorrhea. Here again we encounter the possibility that there is more than one hormone concerned, or that the bleeding is due to a perversion of the secretion — a dyspituitarism — rather than to a simple excess or deficiency. In the case of the adrenals, the work of Bulloch and Sequeira, and many others leaves no reason to doubt that these bodies are closely correlated with the generative organs, although there is no evidence as yet that they may be causative factors in uterine bleeding.

We come, finally, to a consideration of the nervous causes of hemorrhage from the uterus. A few years ago it would have been considered only a fanciful hypothesis to attribute to the nervous system a part in the causation of uterine bleeding. When we consider, however, that such a condition as exophthalmic goiter appears often to follow severe nervous shock, and that Crile has demonstrated that the emotion of fright produces definite structural alterations in the brain-cells, we must certainly have greater respect for the nervous system as a disturber, not only of function, but also of structure. There are many functions of the body which are essentially autonomic, but in which a vestige of voluntary control is still evident. In defecation and micturition the control of the will is still an important factor. In the case of such a function as digestion, the voluntary factor is far less important, while in the case of menstruation, to go still farther, the influence of the volitional factor is

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unrecognizable under normal conditions. And yet even with menstruation the higher centers still retain at least a vestigial degree of control, and under pathologic conditions, this may be greatly exaggerated.

The nervous factor in uterine bleeding has already in a measure been touched on in the discussion of the vegetative nerves as they influence the internal secretion of the ovary. It is scarcely necessary to add that what is true of their influence on the ovarian secretion is equally true as regards their influence on the other internal secretory tissues. No one can as yet say to what extent the influence of these various internal secretions on menstruation is directly chemical, and to what extent it is exerted through the medium of the vasomotor nerves. Like the vasomotor nerves in all other parts of the body, those supplying the generative organs arise ultimately from the cerebrospinal axis, the primary vasomotor center being definitely located in the floor of the fourth ventricle. The center is linked up with the psychic center, thus explaining the occasional occurrence of uterine bleeding as a result of severe emotional disturbance of one form or another. A number of such cases have come under my own observation, of which the following two are typical:

A woman of 42, a multipara, had always menstruated regularly, the flow lasting usually about four days. A menstrual period commenced, Dec. 23, 1913. December 26, as the flow was abating, a Christmas tree in her home took fire, setting the room ablaze. The woman received a severe fright, and within a short while, a profuse hemorrhage set in, lasting for six or eight hours, and then gradually abating.

A girl of 15, who had commenced to menstruate at 13, was brought to the dispensary with profuse uterine bleeding. Her menstruation had never been regular, amenorrhea being frequently noted. There had never previously been any excessive flow. The history given was that an assault on the child had been attempted on the preceding day. On account of the bleeding, it was thought that there might have been some local injury. Examination disproved this, the assault having evidently been unsuccessful. Regular men-

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struation, lasting three days, had occurred five weeks previously. The hemorrhage in this case was apparently due to the nervous shock associated with the attempted assault.

A number of other cases of this type might be cited. Similar cases are reported by Ehrenfest[12] and others. That hemorrhage may be of neurotic origin has been abundantly shown by Brown-Séquard, von Recklinghausen and others. There is nothing very revolutionary in such an explanation, for many other phenomena might be mentioned which illustrate the influence of the psyche on processes which in themselves are essentially autonomic — the "watering" of the mouth at the sight or smell of food, the acceleration of the heart from fright or joy, the sweating so characteristic of intense anxiety, etc. Even more apropos, since they illustrate the influence of psychic disturbances on the vasomotor apparatus, are such phenomena as the blush of shame or embarrassment, or the bleeding from the stomach or even from the skin which has been observed in highly nervous or hysteric women. From a theoretic point of view as well as from clinical experience, we may therefore conclude that certain cases of uterine bleeding are undoubtedly neurotic in origin, or, more properly, perhaps, "angioneurotic."

The close interlocking of the nervous system and the ductless glands makes it possible that severe psychic disturbances produce menstrual aberrations by a direct effect on the functions of the internal secretory glands. Such a phenomenon would be analogous to the glycosuria which has been shown to occur at times in conditions of severe fright and other emotional disturbance, and which is explained as being due to a nervous excitation of the adrenal bodies. This has been corroborated by the failure of the glycosuria to appear if the nerves supplying the adrenals have previously been cut, thus severing the connection of the latter with the psychic centers. I mention this to

12. Ehrenfest: Amer. Jour. Obst., February, 1908.

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emphasize the fact that a direct connection between the psychic centers and the ductless gland chain has been demonstrated experimentally. The nervous factor in uterine hemorrhage, like that of the internal secretions, is most apt to make itself manifest at those periods when the woman's menstrual equilibrium is already unstable, that is, puberty and menopause.

SUMMARY

1. The proper basis for the study of uterine bleeding is the study of normal menstruation, along physiologic as well as anatomic lines.

2. The factors concerned in normal menstruation are (*a*) an ultimate cause, residing in the ductless gland chain; (*b*) a nervous mechanism, essentially vasomotor in character; (*c*) the pelvic organs, and especially the uterus.

3. The causes of uterine bleeding may therefore be grouped as (*a*) fundamental, involving disturbances of the internal secretions; (*b*) nervous, exerting their effect mainly through the vasomotor nerves; (*c*) anatomic, in which structural changes are present in the uterus or other pelvic organs.

4. Most frequently the exciting cause of uterine hemorrhage is anatomic, the lesion being in the uterus, tubes, ovaries, blood-vessels or even the blood itself.

5. In a not inconsiderable number of instances, bleeding is due to fundamental or nervous causes, especially at the two extremes of menstrual life, puberty and the menopause.

6. There is good reason to believe that much light will be thrown on the rôle of the fundamental causes, and perhaps even of the nervous causes, by clinical methods of study which are based on the relation known to exist between the ductless gland apparatus and the vegetative nerve system.

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RADIUM IN THE TREATMENT OF UTERINE HEMORRHAGE AND FIBROID TUMORS

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The association of several diverse pathologic conditions may occasion surprise. Our excuse for presenting them together in this instance is that they have certain characteristics in common, namely, they are all benign, all chiefly troublesome on account of hemorrhage, and all remarkably united in their ready response to ray-therapy.

Until recently the control of uterine hemorrhage and the relief of symptoms of pressure occasioned by fibroid tumors have been possible with certainty only by radical surgical procedures. It is true that many of the time-honored methods have sufficed to tide patients over critical periods and finally allow a return to good health, but there has been a growing tendency in the more resistant cases, which are common, to proceed at once to hysterectomy or to partial hysterectomy in order to secure prompt and permanent relief.

Among the palliative measures known to all are the drugs ergot, stypticin, and calcium lactate, as well as the hygienic measures rest in bed and cold to the abdomen, with the mild surgical procedures, such as curettage and local applications to the endometrium. Notwithstanding the great value of these remedies, they frequently fail, especially in the cases in which relief is most needed. We feel sure that the medical profession has long since given up any expectation of finding a regulative drug to control uterine hemorrhage. It has become as chimerical as the mythical

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tonic for which our patients ask, expecting to secure through it an immediate return of health in broken-down organs and functions. Nevertheless, mysterious and unattainable as such a remedy would seem, it has apparently been found in the invisible rays which proceed from a Roentgen-ray tube and even more so from the radio-active substances, particularly radium.

The benign conditions which we wish to consider in this paper fall readily into four groups, excluding uterine hemorrhages due to cancer and other malignant disease, as well as those due to inflammatory disease of the adnexa, and those due to pregnancy and miscarriage.

The first group includes cases in adult women in which there is marked menorrhagia or metrorrhagia with no disease of the pelvic organs, except perhaps a slight enlargement of the body of the uterus. The endometrium taken from such uteri is microscopically normal. These cases belong to the so-called myopathia hemorrhagica class.

The second group takes in most of the hemorrhages which occur in young girls. In many of these the local findings are exactly as in Group 1. In some instances the condition is similar to that found in Group 3 (polypoid endometrium). Although pathologically this group cannot be separated from the others, it presents marked and distinctive features clinically, and in especial it differs radically in the indications for treatment. It is most important with these patients to avoid both sterility and mutilation.

The third group includes patients suffering with uterine hemorrhages who show no pathologic condition except an extensive polypoid overgrowth of the endometrium, which is generally termed polypoid endometritis.

The fourth group includes true uterine myomas, whether they are causing hemorrhage or merely giving discomfort through pressure on adjacent organs. Here the true aim of treatment is not only to regulate or

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stop the bleeding, but also to bring about the complete disappearance of the tumor.

Before considering the cases it seems proper to review the development of ray-therapy as applied to the conditions which we are considering.

A very interesting and masterly summary of the uses of the Roentgen ray as applied to uterine fibroids and hemorrhages was presented by Albers-Schoenberg[1] at the last International Medical Congress in London. From the very beginning this eminent author has been one of the most aggressive workers in this new therapeutic field and to him is due much of the credit for its present development. In Germany, F. J. Deutsch (April, 1902), in the United States, William James Morton (August, 1902), and in France Foveau de Courmelles (1913), began the use of the Roentgen ray in the treatment of fibroid tumors of the uterus almost simultaneously. Dr. Morton secured priority by a published series of cases[2] showing favorable results in the control of hemorrhage occasioned by uterine myomas. To Foveau de Courmelles belongs great credit in pushing and developing work in this direction. In 1909 he had reported 100 cases successfully treated. An excellent idea of his work, which includes the use of filters, the employment of many fields for deep radiation, is given in his published report.[3]

The use of the Roentgen ray was more or less restricted to Roentgenologists up to 1909, when C. J. Gauss began his work and publications from the gynecological clinic of B. Krönig in Freiburg. In 1912 Gauss, in conjunction with Dr. H. Lembcke, issued their well-known monograph "Roentgentiefentherapie" which represents the first extra volume of *Strahlentherapie*. Gauss, by developing a technic which permits the giving of large ray dosage to the uterus

1. Albers-Schoenberg: Strahlentherapie, Nov. 27, 1913, p. 408.
2. Morton, W. J.: New York Med. Rec., July 25, 1903.
3. Foveau de Courmelles: Strahlentherapie, Nov. 27, 1913, p. 388.

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and ovaries without injury to the skin, succeeded in bringing into the field of ray-therapy practically all uterine fibroids, showing that they could be diminished or made to disappear entirely, that the hemorrhages could be completely checked, and that this could be accomplished without risk to the patient. His admirable work is now being repeated and amplified in almost every gynecologic clinic in Germany as well as in other countries.

To approximate completeness in the long list of the workers who have contributed to the development of Roentgen-ray therapy as applied to the benign conditions of the uterus would demand more space than we have at our command.

In Germany where the work has been most widely carried on, as well as in France, England and in this country, there has been a division into two schools, the one using the intense radiations of Gauss with practically 100 per cent. of success; the other the milder radiations effectual in 75 or 76 per cent. of the cases. In view of the years which have passed and the continued absence of any serious complications it would seem that the Freiburg methods had fairly won their place. By this technic it is possible in from one to three months to obtain complete amenorrhea, and in the fibroid cases to cause a complete or great resorption of the tumor. This is accomplished, let it be carefully noted, without injury to the skin or to the general health.

The use of radium in the treatment of uterine hemorrhage and uterine fibroid, though not so extensive, has a history almost as long. The first work in this direction was that of Oudin and Verchère[4] who applied radium intra-uterine, but found that it occasioned so much irritation and trouble that they abandoned it. Their technic consisted in introducing a tube containing the equivalent of 11 mg. of radium

4. Oudin and Verchère: Ann. d'electrol., Oct. 31, 1906; Oudin, ibid., August, 1907.

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element into the uterine cavity, and leaving it there for fifteen minutes. This treatment was repeated five or six times at intervals of four or five days, the radium salt being contained in a glass tube. Chéron[5] was the first to secure positive results from radium treatment, reporting his technic and results to the Académie de Médecine in 1909. His radium which averaged an equivalent of the 30 mg. of the element was also in a glass tube, and this again enclosed for the purpose of filtration in a silver container 0.5 mm. thick. This apparatus was surrounded by gauze and inserted directly into the uterine cavity or only in the cervix for a total period of seventy-two hours, the time being divided up into separate sessions of from six to eight hours, at intervals of a few weeks. By this method Chéron treated 120 cases of small fibroid tumors, and secured amenorrhea in 117, with a decrease in the size of the tumor in 108. It is his practice to limit the treatment to small tumors, and to exclude markedly anemic patients as well as those under 40 years of age.

Dr. Robert Abbé[6] reports having treated one case of uterine fibroid. He has recently[7] reported two cases treated years ago where excellent results were secured.

The 1912 report of the work at the Radium Institute in London by A. E. Hayward Pinch[8] does not deal largely with the question of uterine fibroids and hemorrhages, two cases being recorded. In neither was there any decrease in the size of the tumor, although the hemorrhages were lessened.

In a paper of fundamental and far-reaching importance C. J. Gauss and B. Krinski[9] state that results in every way equal to those obtainable by the Roentgen-ray treatment, with which they have had so much

5. Chéron: Arch. d'électr. méd. Bordeaux, 1911, xix, 355.
6. Abbé, Robert: Radium in Surgery, THE JOURNAL A. M. A., July 21, 1906, p. 183.
7. Abbé, Robert: Strahlentherapie, 1914, iv, 32.
8. Pinch, A. E. H.: Brit. Med. Jour., Jan. 25, 1913, p. 149.
9. Gauss, C. J., and Krinski, B.: Die Mesothorumbehandlung der Myome und Metropathien, Strahlentherapie, 1914, iv, 440.

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experience, can be secured even more rapidly by mesothorium radiations. They employ 50 mg. of mesothorium, encased in 1.2 mm. of gold and surrounded by rubber, as their apparatus, and treat for from forty-eight to seventy-two hours, following this up in three weeks with a second similar treatment. In fibroid cases amenorrhea was secured on the average in women between 35 and 40 years of age in eight weeks; in women between 40 and 50 in six weeks. The average number of hours of application for the fibroid cases was 176.5. They treated in this way, with mesothorium alone, thirty cases, sixteen of which were myomas, and fourteen metropathias. Amenorrhea was secured in all cases, and the tumor disappeared in all but one case, menopausal symptoms, present in 53 per cent. of the cases, were mild in all except 3 per cent. The applications were apparently given either from the vagina or the cervix, although the authors speak of intra-uterine applications. No complications of any kind were noted.

MODE OF ACTION OF ROENTGEN AND RADIUM RAYS ON UTERINE HEMORRHAGIC CONDITIONS, ESPECIALLY FIBROID TUMORS

It has been firmly established both from animal experimentation and clinical observations on human beings that the Roentgen ray and the penetrating rays from radium are capable of destroying the primordial follicles of the ovary and the spermatogenic cells of the testicle. We have but to mention the names of Albers-Schoenberg, Brown, Osgood, Halberstaetter, Fraenkel, Faber, and many others who have contributed to our accurate knowledge in this direction. As it is the primordial follicles which give rise to the corpora lutea and determine menstruation, these results suggested at once that the penetrating rays might offer a means of causing amenorrhea and sterility. From the older literature it was known that many fibroids ceased to bleed and grew smaller after a double

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oophorectomy. A case of complete disappearance of a large fibroid tumor after this operation occurred in the service of one of us (H. A. Kelly) at the Johns Hopkins Hospital and is reported.[10] Reasoning on the basis of similar experiences, it was felt that the ray therapy had its primary effect on the ovaries and secondarily controlled the pathologic conditions in the uterus. Most of the technics devised for radiation based on this idea have particularly endeavored to concentrate a maximum amount of rays on the ovaries, leaving the tumor more or less out of consideration.

It has been well established both from Roentgen-ray and radium radiation that an obliterative endo-arteritis occurs almost invariably in the field radiated. We have noticed this condition in a marked degree in a number of cases in which we have operated after extensive radiation with radium. The natural conclusion therefore is that the effect on a fibroid tumor is due to the anemia following the occlusion of its nutrient vessels.

Against the conception that the influence on fibroids is mainly indirectly through the ovaries are the facts that many fibroids grow after the menopause, that some grow after the removal of the ovaries, and that marked regressions occur in tumors treated by the ray method in patients past the menopause. For these reasons we believe that there is a *specific and direct action of the rays on the tumor itself,* and we further believe that this happy result can be secured *quite independently of any action on the ovaries.* In the series of fibroids to be recorded in two cases the tumor disappeared without cessation of menstruation! In another already past the menopause there has been marked regression from a single treatment!

TECHNIC

In the tables we give with each case the amount of radium and the duration of the application. The reader will observe at once a wide variation in the

10. Kelly and Cullen: Myomata of the Uterus, 1909, p. 505.

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individual cases. While we feel that the results given can all be duplicated by the same technics, we do not consider the matter of dosages in any sense settled. Our plan has been steadily to increase the milligram-mage while decreasing the time. This is not only for economy and comfort to the patient but because of the better results and fewer complications occurring. The ideal method, where it is not desired to secure amenorrhea, is to limit the radiation so far as possible to the tumor itself, avoiding touching the ovaries. This is best secured by intra-uterine applications. It is sometimes well to reinforce such treatments by abdominal radiation either with radium or the Roentgen ray.

The technic advised is filtration through glass 0.5 mm. of platinum, 0.5 mm. of zinc foil, and 0.3 mm. of rubber. Such an apparatus, suitable shaped, is carefully introduced directly into the uterine cavity. Cervical applications alone we find to be less reliable, demanding much more radiation to secure results. As a preliminary to the introduction of the radium, the patient is given nitrous oxide and then thoroughly curetted, and examined carefully under complete anesthesia; this is indispensable to good work. The amounts used intra-uterine in the fibroid cases have varied from 30 mg. to 560 mg. and the time of application from one and one-half hours to forty-eight. In the young girl class the amount of radium introduced has been as small as 12 mg. In speaking of milligrams radium element is meant; whatever the salt and whatever its purity, in all reports the amount in equivalent of radium element pure should be given. In the case of mesothorium, which varies with age, the strength equivalent to radium element at the time of radiation should also always be stated.

In conjunction with Dr. Robert M. Lewis and other workers of the Howard A. Kelly Hospital we have been using radium in the treatment of these bleeding cases for a year and a half and have had in all 39

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cases: 8 hemorrhagic metropathies, 5 polypoid endometria, 5 irregular bleedings in young girls, and 21 cases of uterine fibroid tumors. All of these latter have belonged to the class of large or medium tumors, none to the group of small tumors to which the treatment is limited by Chéron.

In the first group, that of bleeding uteri of adult women without any demonstrable pathologic lesion, the eight cases are summarized in Table 1. The average age is 38 years, the youngest 27, the oldest 44. All were suffering from anemia and had not yielded to the palliative measures previously applied. The amounts of radium used varied from 60 to 268 mg., the time of exposure from two to twenty-four hours. In two cases (7 and 8) the bleeding never recurred after the first treatment. In one case (3) a second treatment was necessary. In the remaining 5 cases a normal menstrual period followed at the regular time to be followed by complete amenorrhea. The average time from treatment to complete amenorrhea was 3½ weeks. Mild menopausal symptoms occurred in 3 cases, marked menopausal symptoms in one case, and none in 4 cases. The patients all left the hospital within forty-eight hours and except for a slight abdominal burning which lasted two or three weeks and which was accompanied by some leukorrhea, have had no bad results. All now report themselves in good health.

In the third group, of adult women with uterine hemorrhage and no disease except a polypoid endometrium, there are 5 cases the details of which are given in Table 3. The average age was 43 years; the oldest 49 years, the youngest 35 years. Except in Case 1, in which a combined uterine abdominal and vaginal application was used, only the intra-uterine method was used. The amount of radium employed varied from 100 to 30 mg. The duration of the treatment was from twenty-two to seven hours. With the

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exception of Case 1, in which bleeding led to hysterectomy five days after application, all were relieved at once by the single application. All these patients were anemic, all had resisted other forms of treatment, all have regained their normal condition since treatment. In 2 cases menopausal symptoms were slight. In 2 cases they were not present. Case 1 is not included as here oophorectomy and hysterectomy was carried out.

In the second group, which includes young girls who were bleeding, there are 5 cases, the tabulation of which is given in Table 2. The ages varied from 13 to 23, the average being 18 years. In addition to the usual medicinal treatments, all but one had had curettages and one had had a resection of the ovaries, with the idea of diminishing the period. All were in general good condition except for the anemia, with the exception of Case 5, in which there was extreme organic heart disease. The amount of radium used varied from 12 to 60 mg. The time of application ran from five to twenty-four hours. In the first three cases the menstrual periods have returned to the normal type and the patients recovered a normal hemoglobin content.

In Case 4 there was amenorrhea lasting two months, then a return of menstruation, which has been a little irregular at intervals of from three to five weeks but never excessive. In the fifth case, where the application was through the abdominal wall, complete amenorrhea with distinct menopausal symptoms was produced. Where we desire to diminish hemorrhage the treatments are short and the milligrammage small, although it is harder to produce a complete amenorrhea in this group than in women over 40.

In the fourth group, which includes the fibroids, there are 21 cases; the average age is 44; the oldest 59 years; the youngest 32 years; menorrhagia, mettrorrhagia or both, were present in 19 cases; in one

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there was normal menstruation, in one no menstruation, as patient was six years past menopause.

The tumors with one exception (Case 10, Table 4) were either large or middle sized. By large we mean those reaching half way to the umbilicus or larger, while middle-sized tumors include those from the size of a two and a half months' pregnancy half way up to the umbilicus.

In 3 cases the tumor was definitely submucous. With the exceptions of Case 5, in which there was an ovarian cyst, and Case 16, a cystic ovary, and Case 20, chronic pelvic inflammatory disease, and Case 8, marked exophthalmic goiter, and Case 10, infection of the tumor and uterine cavity, the fibroid condition was uncomplicated. The amounts of radium and the duration of the application are shown in Table 4.

In Case 8 the application was atypical, in that radiation had been given with the Roentgen ray both prior to and after the radium radiation. Owing to the extreme illness of this patient the ordinary technic was not followed and the application was made through the abdomen. In Case 21, the only failure in the group, the application was also atypical, from the abdomen and from the cervix. At the time this patient was treated it was not realized that the intracervical treatments require much longer times of exposure. Here, owing to the tortuosity of the cervical canal, the introduction of the tubes into the uterus was difficult. After the failure, however, it was thought better not to radiate further, but to treat surgically.

These patients almost invariably suffer from nausea for twenty-four hours, and from abdominal tenderness for from ten days to three weeks, and some of them have leukorrheal discharge for a few weeks. The symptoms above enumerated have been much less marked when large amounts of radium are used for relatively short times. In only one case, No. 20, has any serious complication followed the treatment. Here an inflammatory process was lighted up and a

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pelvic abscess formed. It healed, however, without operation, and the patient is perfectly well to-day.

EFFECTS ON HEMORRHAGE

In 16 of the 21 cases, complete amenorrhea has been obtained; immediately after the treatment in 6 cases, at the end of one month in 4 cases, at the end of two months in 4 cases, at the end of several months in one case (3) in which the milligrammage and hours were small. In one case the patient is six years beyond the menopause and there was no bleeding. In one case, No. 21, the treatment failed. In one case, the time since treatment is too short to state the effect. In two cases, and these in our opinion are most important, *the menstrual periods have persisted regularly and the tumors have disappeared.* The details of these two are shown in Table 4, Nos. 4 and 11.

This happy result must be due to the fact that the fibroid has received much more intense radiation than the ovaries, and serves to point the way in which to extend our efforts in this field, that is, *to secure a maximum effect on the tumor with a minimum treatment of the ovaries.* This observation, which reverses the European technic, is possibly applicable to Roentgen ray as well as radium treatments.

The effects on the tumor are as follows:

Case 1, from the size of three months' pregnancy to six weeks' pregnancy.

Case 2, tumor 4 inches in diameter has completely disappeared.

Case 3, tumor 6 inches in diameter has completely disappeared.

Case 4, uterus and tumor size of three month's pregnancy reduced to size of normal uterus.

Case 5, tumor 9 inches in diameter reduced to one 4½ inches in diameter.

Case 6, a huge tumor filling pelvis and lower abdomen has entirely disappeared.

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					hemoglobin 50 per cent.		
681	Case 11 Miss B. S.	39	3/16/14	About 1 year	Menorrhagia and metrorrhagia; marked anemia.	Subperitoneal, interstitial and submucous, reaches to 1 cm. of umbilicus.	Norma.
825	Case 12 Mrs. A. L.	38	4/30/14	1 year	Menorrhagia, marked.	Uterus size of 6 weeks' pregnancy; attached to its right wall is a fibroid 5 in. in diameter filling the right broad ligament.	Norma'
771	Case 13 Mrs. L. H. C.	44	4/20/14	1 year	Menorrhagia 10 days, but not very anemic looking.	Interstitial, 15 cm. in diameter, reaches half-way to umbilicus, fills pelvis.	Norma'
333	Case 14 Mrs. C. N. B.	43	10/ 8/13	4 years	Menorrhagia	Interstitial; uterus and tumor inseparable; fully 6 in. in diameter; reaches half-way to umbilicus.	Normal
334	Case 15 Mrs. C. E. D.	40	10/20/13	2 years	None	Interstitial; inseparable from uterus; size of large cocoanut; reaching almost to the umbilicus.	Normal
370	Case 16 Mrs. H. W. T.	59	11/ 6/13	4 years	Although 59 yrs. old patient is apparently still menstruating; for 4 years has been having irregular excessive menstrual periods.	Interstitial; size of 4 months' pregnancy; reaches half-way to umbilicus.	Appare cystic l ovary.
394	Case 17 Mrs. A. McG.	46	11/18/13	2 years	Rather marked menorrhagia; symptoms of pressure.	Uterus size of 3 months' pregnancy; freely movable; growth interstitial.	Normal
375	Case 18 Mrs. W. T. D.	33	12/10/13	1½ years	Menorrhagia 8 days.	Interstitial, subperitoneal, irregular; fills pelvis and lower abdomen.	Not made
792	Case 19 Miss M. L. C.	49	4/25/14	At least 10 years.	None. Patient is past menopause 6 years.	15 cm. in diameter, in right broad ligament; uterus to left of tumor; size of 6 weeks' pregnancy.	Normal
614	Case 20 Mrs. A. H. M.	46	2/ 6/14	1 year	Very marked menorrhagia; marked anemia.	Uterus about twice normal size; one subperitoneal fibroid on anterior wall measures 4 cm. in diameter.	Pelvic infl matory ease; chro
340	Case 21 Miss A. A.	32	10/ 8/13	2 years	Menorrhagia 8 days.	Uterus 10 cm. in diameter, round and globular.	Normal

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l	300 mg. 1½ hrs. April 25 1,100 mg. 2½ hrs. on abdomen.	Twenty-four hours nausea; soreness in abdomen for 10 days; temperature 1 degree above normal for 8 hrs.	None	Normal menstrual periods in March, April, May and June. On April 25 growth one-half original size. *On June 14 growth found to be entirely gone.*
l	560 mg. 3 hrs.	Little nausea	None	Rather profuse menstrual period in May. None up to present time in June; *growth is about half original size.*
l	400 mg. 1½ hrs.	None	None	No report secured.
.	60 mg. 24 hrs. 300 mg. 21 hrs. from abdomen.	Nausea 3 or 4 days, marked discomfort in pelvis for 1 month.	None	No further menstrual period; general health splendid; uterus normal in size, small, attached to its right wall; a small pedunculated myoma 1 in. in diameter.
	100 mg. 26 hrs. 60 mg. on abdomen 1½ hrs.	Nausea for 24 hours.	None	Normal menstrual period in November; none since then; general condition splendid; no menopausal symptoms; tumor practically gone; uterus freely movable; slightly larger than normal; no fibroid can be felt.
ntly : f t	100 mg. 24 hrs.	No upset.	None	No further bleeding; splendid health; growth reduced to one-third original size.
	60 mg. 17½ hrs. 60 mg. 2 hrs., 1/6/14.	Period in December, rather excessive; none since.	None	Feels splendidly; no menopausal symptoms; no bleeding; tumor entirely gone.
out	60 mg. 18½ hrs.	No disturbance.	None	One menstrual period; since then complete amenorrhea; growth reduced to one-third original size; splendid health.
	150 mg. 6 hours	None except leukorrheal discharge.	None	June 5 tumor only 7 cm. in diameter; general condition of patient excellent.
am- dis- mic	170 mg. 13 hrs. 15 min.	Nausea and vomiting; some temperature; abdominal pain for 3 weeks.	Lighting up of pelvic inflammatory disease with formation of pelvic abscess.	No further menstrual periods; pelvic abscess healed spontaneously; no menopausal symptoms; uterus normal in size; general condition splendid.
	30 mg. 25 hrs. 10/19/13 300 mg. 11 hrs., abdominal, 10/19/13 35 mg. 10 hrs. 11/18/13 35 mg. 12 hrs. 11/20/13 60 mg. 25 hrs. 1/7/14 400 mg. 6 hrs. abdominal 1/7/14	No upset except nauseated a few hours after application.	None	Neither tumor nor hemorrhages markedly changed. The applications here were to the cervix and not intrauterine. Radical operation carried out 3/14/14.

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Case 7, uterus and tumor size of a two months' pregnancy reduced to the size of a normal uterus.

Case 8, no report on size of tumor, except that it is markedly smaller.

Case 9, huge tumor filling pelvis and abdomen to umbilicus reduced to the size of a two and one-half months' pregnancy.

Case 10, uterus and tumor the size of three months' pregnancy now a normal uterus.

Case 11, tumor reaching to within 1 cm. of umbilicus reduced to the size of a six weeks' pregnancy.

Case 12, tumor 5 inches in diameter reduced to 2½ inches in diameter. Duration of observation only six weeks.

Case 13, no report obtained.

Case 14, tumor 6 inches in diameter reduced to 1 inch in diameter.

Case 15, tumor size of four months' pregnancy reduced to that of a six weeks' pregnancy.

Case 16, tumor size of four months' pregnancy reduced to one of six weeks' pregnancy.

Case 17, uterus size of three months' pregnancy reduced to a normal uterus.

Case 18, huge tumor filling pelvis and lower abdomen to umbilicus reduced to one-third original size.

Case 19, six years past the menopause, tumor 6 inches in diameter reduced to one 3 inches in diameter, and still decreasing.

Case 20, uterus twice normal size, reduced to normal size.

Case 21, practically no change in size of tumor which is about 4 cm. in diameter.

With intense radiation of the fibroids, the reduction is usually rapid, occurring within two or three months. Where the principal effect has been on the ovary, the disappearance may be much slower extending over months or even years, as in the cases reported by Robert Abbé.[6, 7]

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CONCLUSION

We feel sure as the result of these remarkable experiences that radium offers a marvelous means for controlling, as well as for completely doing away with uterine hemorrhages, in the classes of cases cited.

We believe also that it is perfectly suited to secure the disappearance of fibroid tumors. A radium treatment ranks in severity as scarcely more serious than a simple uterine curettage.

In its brilliancy of curative results it is fully equal to radical surgical procedures while offering the advantages of freedom from danger, pain, suffering and the various postoperative complications and sequelae. Furthermore, when radium fails we still have the operation to fall back on and have not lost in the waiting. As compared with the Roentgen ray, radium is simpler of application, more rapid in bringing about the desired effect, and finally is better in that it acts on the diseased organ, the uterus, with more intensity than on the ovaries. Radium offers the possibility in the fibroid cases of doing away with the tumor without destruction of the ovaries.

We also insist that the fibroid itself should receive the major radiation, whether with the Roentgen ray or with the radium.

The radium can bring about a complete amenorrhea at any age.

The menopausal symptoms which follow this amenorrhea are absent in 50 per cent. of the cases and mild in nearly all of them.

We insist on the intra-uterine application, in contradistinction to the vaginal or cervical, and in this connection wish to contrast the shortness of the radiations in hours as compared with the exposures reported by Chéron[5] and Gauss and Krinski.[9] We feel that it is quite possible that suitable abdominal radiation with radium or the Roentgen ray may add to the rapidity of the results.

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ROENTGENOTHERAPY IN UTERINE HEMORRHAGE

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The treatment of uterine hemorrhage by means of the Roentgen rays, is no longer a novelty, but has become an established method in most of the leading clinics in Europe, and is being well established in America. The first cases were treated and placed on record ten years ago by Deutsch. Since then reports have been made by several hundred roentgenologists and gynecologists, and the number of cases now definitely recorded are considerably over a thousand. There has been sufficient time for all the doubts and fears to have materialized, but instead, all hopes have been realized, the technic has been fairly well established, and the indications and contra-indications reasonably well outlined, so that to-day the method stands as one of the most brilliant achievements of roentgenology.

In 1904 Deutsch[1] found that the rays relieved four cases of uterine hemorrhage connected with fibroids. This report seemed to have been forgotten until Foveau de Courmelle[2] made a report on forty-five cases of uterine fibroids in 1906, and on fifty-three in 1907. I[3] began treating these cases in January, 1906. Since then the publications on this subject have been so numerous that it would require all the time allotted to me for this paper, if I only referred to them.

1. Deutsch: Die Radiotherapie bei Gebärmuttergeschwülsten, München. med. Wchnschr., 1904, p. 1646.
2. Foveau de Courmelle: Action atropàique glandulaire des rayons X, Compt. rend. de l'Acad., 1907, cxl, No. 9, p. 606.
3. Pfahler, George E.: Roentgen Therapy in Gynecology, New York Med. Jour., June 25, 1910.

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THEORY OF THE ACTION OF THE ROENTGEN RAYS IN GYNECOLOGY

It has been proved by experiments on animals and human beings (Albers-Schonberg,[4] Phillips,[5] Halberstaedter,[6] Heineke,[7] and others), that the ovaries and testicles are the most sensitive of all the tissues of the body to the action of the Roentgen rays, and that these organs can be seriously affected without producing visible effects on the overlying skin. It is likely that the results referred to in this paper are chiefly due to this special action of the rays on the ovaries, and secondarily to their direct effect on uterine fibromas, the uterine tissue, and malignant cells, when present.

If the activities of the ovaries send out a stimulus to prepare the mucous membrane of the uterus for the reception of the ovum, and the degree of this stimulation governs the menstrual flow, then the depression of this function will decrease the menstrual flow and finally lead to its obliteration. This lack of congestion and nutriment probably leads to an atrophy of the fibroids. By decreasing the hemorrhage, at least such pains as are due to the expulsion of the clots will be relieved, and by decreasing the functions of the ovaries there is probably a decrease in the irritability of the nervous mechanism of the ovaries, thus bringing about, consequently, a relief in the dysmenorrhea of neurotic subjects.

Saretzky,[8] in a series of experiments on sixty-two rabbits, found the ovarian tissue to be especially sensitive to the rays, and, of the ovarian tissue, the ripe and ripening follicles were first affected. Only the weakest dose showed no effect. Progressively increasing

4. Albers-Schonberg: Ueber eine bisher unbekannte Wirkung der Röntgenstrahlen auf den Organismus der Tiere, München. med. Wchnschr., 1903, 1, 1859.

5. Phillips: Die Röntgenbestrahlung des Hoden des Mannes, Fortschr. a. d. Geb. d. Röntgenstrahlen, viii, 114.

6. Halberstaedter: Die Einwirkung der Röntgentstrahlen auf Ovarien, Berl. klin. Wchnschr., 1905, No. 1.

7. Heineke: Ueber die Einwirkung der Strahlen auf Tierische Organe, München. med. Wchnschr., 1903, No. 18, 1904, No. 18.

8. Saretzky: Durch Röntgenbestrahlung der Ovarie hervorgerufene Amenorrhea, Ref. Geb.-Gynäk. Gesellsch. in St. Petersburg, Nov. 20, 1903; Fortschr. a. d. Geb. d. Röntgenstrahlen, Nov. 20, 1908, p. 42.

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doses affected, in proportion to the quantity of treatment, first the ripe and ripening follicles, then the prefollicular cells and, finally, the interstitial tissue.

At certain stages he found that a beginning atrophy of the follicles undergoes a regeneration, the ovarian tissue develops anew and the ovaries entirely regain their functions. If the treatment is persisted in, however, a complete atrophy takes place. He found that if only one ovary was treated, the other ovary and the entire genital tract retained their normal functions, and the animal was capable of reproduction.

Based on these theories and experiments, we easily find the explanation of the fact that, as we approach the menopause, the quantity of treatment needed to produce sterility and an artificial menopause is very much less than is needed in younger patients in whom the functions of the ovaries is very much more active and the resistance greater. The resistance of the ovaries in younger people is sometimes remarkable, and on this account the Roentgen-ray treatment is not the method of choice in patients under 40 years of age. One patient, aged 34, whom I treated over the spleen and abdomen for chronic cyanotic polycythemia and who received a great deal of treatment over the pelvic region during two and a half years, became pregnant and gave birth to a healthy child who is now 4 years old.

Good results of roentgenotherapy, as given by Albers-Schonberg in 1909 and confirmed by myself and many others, are as follows:

1. A cessation of the menses, and associated with this (*a*), a decrease in the size of the myomas; (*b*) a decrease or cessation of the hemorrhage associated with myomas, whether it be menstrual or intermenstrual; (*c*) a disappearance of the pains associated with myomas; (*d*) a cessation of preclimacteric hemorrhages or pains, whether due to myomas or not; (*e*) sterilization when indicated.

2. The obliteration of postclimacteric hemorrhage.

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3. Disappearance or healing of myomas unassociated with bleeding, such as occurs after the menopause.

4. The control of menstrual disturbances at any age, at times without sterilization and, when necessary, with sterilization.

INDICATIONS AND CONTRA-INDICATIONS

The treatment of uterine hemorrhage by means of the Roentgen rays really consists in the treatment of the causes of the hemorrhage, and, I believe, of first importance, is a careful diagnosis made by a competent gynecologist or by one who is capable of making an accurate diagnosis. There is still some difference of opinion as to the indications and contra-indications for treatment. Those who are most skilful, and who have had most experience, are generally most enthusiastic. As a result their indications cover a wider field, and the contra-indications are fewer.

Indications in Hemorrhages Due to Myomas.—1. All cases of myoma in older women in whom there is already a well-advanced anemia, which may be the cause of an anemic heart. 2. All elderly and young women with myomas, in whom there is marked organic heart-disease, diabetes mellitus, chronic nephritis, marked lung-disease and goiter with cardiac symptoms. 3. All patients beyond the age of 40, in whom there is no contra-indication to the treatment. In general, the older the patient, and the nearer she has approached the menopause, the more prompt and satisfactory will be the result. Under 40, roentgenotherapy is not the method of choice, but good results can be obtained, though the younger the patient, the more treatment will be required. 4. The intramural, or the interstitial variety of tumor gives the best results.

Contra-Indications.—1. All cases of myomas in which the tumor is pedunculated, or which can be excised without destroying the reproductive powers of the patient. 2. Fibroids that have undergone malignant degeneration, or that have become gangrenous,

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should not be treated. 3. Fibroids associated with disease of the adnexa. 4. Fibromas which are producing such marked symptoms that the patient is endangered more by waiting two or three months for results of roentgenotherapy, than by the result of an operation.

RESULTS TO BE EXPECTED IN THE TREATMENT OF FIBROIDS

The decrease, or cessation of the hemorrhage, is the first result to be expected. The effect is more prompt the older the patient, or the nearer the menopause has been reached. Generally there is a decrease or cessation of the flow within a month or two after the first two series of the application of the rays. At times, after the first series of treatments, there may be an increase in the hemorrhage; in fact, the two subsequent menstrual periods may at times be increased. Generally, the first menstrual period following the first series of irradiations is not decreased and is at times increased. The second period, which usually follows the second series of irradiations, is usually diminished and the third menstrual period commonly disappears. The increase in hemorrhage following the first series of irradiations, is due to the stimulating effect of the rays on the cells. Following this the vitality of the cells is depressed, and finally destroyed. Increase in hemorrhage is more often observed with the subserous variety of fibroids, and in patients who are very anemic. Therefore, when one begins treatment in this class, there should be a special effort made to place the patient in bed following the treatment, and the attending physician should be prepared, if necessary, to tampon the vagina. In none that I have treated has this been necessary.

In patients beyond the age of 40, there are usually required from three to six series of irradiations given in from three to five months. The number of series will depend somewhat on the number of doses, or amount of treatment, given in each series. In patients under 40, considerably more treatment will be needed

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than in the older patients, and at times it seems only possible to stop the intermenstrual flow, and restore the menses to a normal quantity. At times the cessation of hemorrhage is almost miraculous. In one patient, the bleeding, which had been constant, stopped after the application of one full dose. With the establishment of permanent amenorrhea or an artificial menopause, the patient is likely to have the same group of symptoms which occur with a normal menopause. They are more likely to occur if the menopause has been produced rapidly. In my cases only three patients complained of such symptoms as flashes of heat, a dull headache and restlessness.

With the cessation of hemorrhage, the general health improves, the patient regains color, weight, strength and appetite; sleep improves and the hemoglobin and red corpuscles increase to nearly normal. Albers-Schonberg urges most strongly that each patient have a record made, at the beginning of treatment, of the amount of hemoglobin and the weight. Both the hemoglobin and the weight should be recorded repeatedly during the course of treatment, for if there is no increase in the weight and hemoglobin, he thinks we are justified in understanding that the case is not purely one of myoma, but should always make one suspicious of a malignant disease. One must, of course, bear in mind that other conditions than that of malignancy may be the cause of loss of weight, and it is only when one cannot account for the loss of weight by any other means, that it should be attributed to a possible malignancy.

The tumor is usually the last to show any effect. Occasionally it decreases in size before the bleeding ceases. Generally there is a decided reduction in the size of the tumor at the time of cessation of treatment, and the reduction continues from this time forward. For instance, if the tumor extends to the umbilicus at the time of beginning of treatment, at the end it may be the size of an orange. The tumor continues to decrease in size long after the cessation of treatment.

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In one case, the tumor originally extended to the umbilicus. At the end of two years it was the size of an orange, and at the end of five years had disappeared. In another case, the tumor originally extended to the umbilicus. At the end of two years it was very much reduced, and at the end of four years it could not be found. In 75 per cent. of my patients who have ceased treatment, the tumor has disappeared. With a decrease in the size of the tumor, the pressure symptoms disappear.

The question of malignant degeneration subsequent to this treatment, has been raised. No such case has been observed.

The relief of pain will depend in great part on its cause. If it is caused by pressure of a large fibroid, the pain, of course, will not be greatly relieved until there is sufficient reduction in the size of the tumor to release the pressure. If the pain is due to hypersensitive ovaries or ovarian excitability, it will be relieved comparatively early, because the earliest effect of the rays is shown on the ovaries. Such conditions sometimes exist in dysmenorrhea. The relief of pressure symptoms, such as constipation, swelling of the lower extremities, irritability of the bladder, etc., will, of course, await the reduction of the size of the tumor, and, since this is the latest effect to be seen, it may persist for several months after beginning treatment.

HEMORRHAGES DUE TO MALIGNANT DISEASE

Some good results have been recorded from the treatment of malignant disease of the uterus. I began the treatment of malignant disease of the uterus thirteen years ago. In the first patient I apparently obtained brilliant results, with complete disappearance of the disease, which at the beginning was an ulcerating mass filling the entire pelvis, hopelessly inoperable. The patient returned to the hospital one year later for the treatment of a severe Roentgen dermatitis, or degeneration. At this time there was no evidence of malignant disease in the pelvis.

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Following this I treated, in all, fifteen cases. All were inoperable or recurrent. In all I got some reduction in the hemorrhage and some improvement in the general symptoms, but, in the end, all the cases but the first case were failures. During the subsequent eight years I then refused to treat such cases, but during the past six months I have taken new courage and enthusiasm from the general results obtained in deep roentgenotherapy.

I have under treatment now, five recurrent cases, following hysterectomy. In all there has been some improvement, some reduction or disappearance of the bloody discharge, relief from pain and improvement in the general health. One seems to have gotten well. In one other case there was no improvement, and the patient died about six weeks after the first and only series of treatments, from ulceration into the bowel. The attending physician believed that this was only the natural course of the disease and not due to the treatment, for there was no damage to the skin.

At the International Congress at London, 1913, Kroenig referred to ninety-six cases of carcinoma of the uterus which had been treated with radium and Roentgen rays, radium being used for the local effect and the Roentgen rays used over the abdomen for the general effect. In forty-six cases of these, the lesions were healed. The longest period of healing, however, had only been one and one-half years.

A review of the twenty-one cases treated by Albers-Schonberg (reported at the International Congress at London, 1913), shows encouraging results, but he feels that several years must pass before we can draw any accurate conclusions.

In general, while we now have some encouragement in the treatment of malignant disease of the uterus, it is not sufficient to justify us in recommending it to replace operation. We should, therefore, urge immediate operation in all cases in which the diagnosis is made while in an operable stage.

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For the present we should only recommend roentgenotherapy in the inoperable and recurrent cases. While such cases are correspondingly more difficult, and, therefore, our statistics equally poor, we can hope to do some good in all, and each patient that recovers is just one more saved from the grave. It is to be hoped, however, that such patients will be referred immediately and not allowed to progress for months, and then in the terminal stage sent with the hope that a miracle can be performed.

I believe, too, that the results that have been obtained in the treatment of deep-seated malignant disease justify the surgeon in recommending postoperative roentgenotherapy in all cases operated on. This treatment should be given as soon as the patient can be safely removed to the laboratory. It should be given vigorously, but carefully and skilfully. The possession of Roentgen apparatus is no more a guarantee of skill in roentgenology than is the possession of surgical instruments a guarantee of skill in surgery.

METROPATHIC HEMORRHAGE

Under this heading Eymer and Menge include the following:

1. Cases of bleeding connected with disease of the uterus in which there is no tumor or none recognizable, cases of so-called "metritis."
2. Cases of hemorrhagic endometritis.
3. Climacteric hemorrhages, which are not malignant in origin. In this class of cases deep roentgenotherapy has accomplished good results, and is especially indicated.

Roentgenotherapy has also accomplished good results in some cases of hemorrhage connected with inflammatory disease of the adnexa (Menge), and is indicated in those cases in which operation is contraindicated for some reason or other.

TECHNIC

In general, the object of the treatment is (1) to depress or obliterate the functions of the ovaries, thus

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producing an amenorrhea or oligomenorrhea; and (2) to cause an atrophy of fibroids, if present, (*a*) by action on the ovaries; (*b*) by direct action on the tumor; (3) to cause degeneration of the carcinoma cells, which should be replaced by healthy connective tissue; and (4) to restore the bleeding mucous membrane in the metropathic cases, to a normal or healthy condition. This should be accomplished without damage to the skin, the bowels or the lymphatic glands, with a fair degree of certainty and within a reasonably short time. Therefore, the greatest attention must be given to technic. To learn this technic, one must learn the principles of roentgenography, as well as roentgenotherapy. This technic is not easily learned, or more men would know it.

The exciting instrument should give a uniform current of high voltage, and sufficient in quantity to excite any given tube to a high degree of efficiency. Previous to the development of the Coolidge tube, I preferred the high-power, high-speed static machine, 40 plates. Since the development of this new tube, which marks a wonderful advance in roentgenotherapy, I prefer the transformer type of inductor having a rhythmeur attachment, which I believe gives the greatest degree of efficiency, and enables one to give a dose in the shortest period of time. In using this very powerful type of equipment, however, special skill is necessary or harm will result. In general, any type of exciting apparatus can be used if the proper balance is maintained between the amount of current used and the proper degree of penetration of the rays from the tube, with a corresponding duration of the treatment. Therefore, the induction coil, transformer type of inductor or the static machine can be successfully used.

The tube should be one that will keep a constant high vacuum of from 7 to 8 Benoist. If the tube is allowed to get soft, the rays will be absorbed in the superficial tissues, resulting in a burn, and the deep effect on the ovaries will not be obtained. Since the development of the Coolidge tube and one or two other

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recent types, it is possible to adjust the degree of vacuum at will and maintain it uniformly, at the same time using a large quantity of current.

The most practical distance of the target of the tube from the skin of the patient, with our present type of holder and present shape of tubes I have found to be 8 inches. Later, I think we shall develop apparatus which will permit us to get nearer and so to get a greater quantity and more divergence of the rays, which will pass through the small area of skin.

The field of application of the rays is over the diseased area, and in the case of fibroids should be especially directed toward the ovaries, and include the fibroid from every possible direction. The rays should be confined to the area treated as much as possible. If a rapid result is desired, large doses must be given, and since one must not exceed the tolerance of the skin over any particular area, the field of application must be subdivided in such a manner that, by cross-firing, an increased dose will reach the deep tissues without affecting the skin. It is this subdivision of the skin-area which has permitted the large doses especially referred to by Gauss and Lembcke and usually spoken of as the Freiburg technic, in which they aim to give all the treatment necessary at one time. This is the other extreme of the swing of the pendulum, as compared with the often repeated, very small doses which were first used by myself and others. It has, however, landed the more conservative man into the middle-road technic, which consists in giving full doses through a number of fields at one time rather than often repeated small doses through the entire lower abdomen, scattered over a long period.

The Freiburg technic is very often spoken of in contradistinction to the Hamburg, or Albers-Schonberg technic. It must not be forgotten, however, that all the prominent roentgenologists are progressive, and what was referred to as the Hamburg or Freiburg technic a year or two ago, is not referred to as the Hamburg or Freiburg technic of to-day. The leaders

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of both these centers have come closer to a middle course. Albers-Schonberg, like the rest of us to-day, divides the area into a number of subdivisions, and the leaders in Freiburg are making much fewer subdivisions. At present I am guided by the size of the abdomen, the depth of the tissues to be treated and the extent and the nature of the disease. For instance, if I am treating a small fibroid which is entirely in the pelvis and is in a thin patient, the subdivisions and fields for the entrance of the rays can be at a minimum, and good results can be obtained by giving a series of treatments through three fields anteriorly and one field in the perineal region. On the other hand, if the fibroid is large and the abdomen thick, I commonly divide the area into twenty-five or more doses, and in carcinoma of the abdomen I at times treat through thirty-five or forty subdivisions, giving the limit of skin tolerance through each area. So, too, when one is dealing with malignant disease or when one is very anxious to produce very rapid results, the quantity of treatment given in any particular series must be correspondingly increased, and, in order to increase this total dosage, the number of points of entrance of the rays must be correspondingly increased. Generally, in the treatment of fibroids, I believe it is not desirable to bring on a very rapid menopause, for by producing this change gradually, there is given an opportunity for the system to accommodate itself to the change.

Albers-Schonberg[9] has expressed very well the present guiding principles that should govern us in the quantity of treatment, in saying that only such a quantity of rays should be applied as is necessary to produce a satisfactory result, uninfluenced by the duration of the treatment. One can readily see, therefore, that in principle, his ideas are similar to mine—that careful judgment should govern us in each particular case, and that a general rule is no more applicable to

9. Albers-Schonberg: Tr. Sect. Radiology, Seventeenth Internat. Cong. of Med., London, 1913.

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all cases in this treatment than is a general rule applicable for an operation to suit all cases.

The time required to give any particular series of treatment will depend on the character of equipment and the technic of the individual operator, as well as on the condition and circumstances of the patient. Generally I use one, two or three days to give any series of treatments, depending chiefly on the number of doses that have to be given in a series. The total dose given in any series varies from 40 to about 800 X. The interval between any series of treatments should not be less than two weeks, and I believe more safely, not less than three weeks.

In one case, in which the malignant disease had matted together all the abdominal viscera, as found by an exploratory operation, I repeated the treatment in two weeks, and in several areas obtained a severe dermatitis. Fortunately, however, these skin ulcerations are practically healed, and the malignant disease in the abdomen, so far as I can tell, has disappeared.

The favorable time for treatment is immediately after a menstrual period. When one has a choice in the matter, the treatment should at least be given ten days before the beginning of the succeeding period. If the bleeding is continuous, the treatment should be given just after the time that would correspond to a period. The skin dose, or total quantity of rays applied to the surface should be carefully measured so as to avoid burns.

A dose refers to the amount of rays that the skin will tolerate without producing more than a slight erythema. This dose, measured by the Kienbock quantimeter, is referred to as 10 X. Measured by the Sabouraud and Noire pastiles or disks, it is recognized as Tint B; or, measured by the Holzknecht radiometer, it would correspond to 10 units. As referred to in the general literature, the units 10 X (Kienbock) or 5 H. (Holzknecht) correspond to an erythema dose, given without filtration. With filtration, this dose, when measured under 3 mm. of aluminum, can be increased

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to from 20 to 30 X. To do this, however, one must have a tube that is giving uniform rays.

Filters should be used to cut off the rays that are mostly absorbed by the skin. For this purpose the leather filter, first recommended by myself,[10] has served well. On top of this I now add for this deep roentgenotherapy, 3 mm. of aluminum, and I place these just above the diaphragm of the tube stand.

At present I am giving a dose of 30 X through each area treated. I am not prepared to recommend this extremely high dosage for general use, and would like to add a word of caution to anyone who has not thoroughly mastered his own technic. Therefore, when I treat a case through four fields, it means that the patient is getting 120 X. If the patient is treated through 30 fields, it means 900 X. In this connection I would like to add what Albers-Schonberg has already said, that no case should receive more treatment than is necessary to produce permanent results, and without regard to the speed with which these results are to be obtained. In the treatment of malignant disease, one must use enormous doses to accomplish results.

Skin effects, in the hands of skilful operators, have been of almost no consequence. In a number of patients treated an erythema developed, and in others the skin became pigmented or tanned. These effects disappeared, leaving the skin undamaged. In a few cases a dermatitis of the first degree has been produced. In these later cases telangiectases develop in the skin about a year later. In the treatment of malignant disease, skin irritation is of secondary importance, but one should never go beyond the production of a slight erythema.

DISADVANTAGES AND ADVANTAGES OF THE TREATMENT

The disadvantages are the following:

1. The prolonged course of treatment that is usually necessary. This can be somewhat shortened by giving enormous doses through a large number of

10. Pfahler, George E.: Tr. Am. Roentgen-Ray Soc., September, 1905.

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fields. If by this means the course of treatment is reduced to two or three months, it will probably only equal the time required for operation and convalescence therefrom.

2. There is danger to the overlying tissues, if the rays are not properly applied. By careful attention to the technic and exact measurements of the skin dose, this can be eliminated.

3. It has been claimed to be more expensive than operation. In a sense this is true. If one considers, however, that by this treatment the expense of board and hospital care is eliminated, both in the case of charity and private patients, and that in both instances they can go about their usual duties, I believe we must conclude that it is not more expensive.

The advantages are:

1. It is painless.
2. It avoids the shock of an operation.
3. It preserves to a certain extent, we believe, the internal secretion which is lost in a complete oophorectomy.
4. It does not interrupt the usual habits.
5. Confinement in a hospital is avoided.
6. In the hands of a skilful operator it is without risk.
7. The menopause is brought on gradually, when necessary.
8. The amount of treatment can be graded to the needs of the patient.

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ABSTRACT OF DISCUSSION

ON PAPERS OF DRS. NOVAK, KELLY AND PFAHLER

DR. CHARLES C. NORRIS, Philadelphia: As I view the subject it is largely one of the study of etiology—in other words, to treat uterine hemorrhage intelligently we must be cognizant of its cause. Uterine hemorrhage is a symptom and not a disease, and no rule of thumb can be successfully employed in its treatment. If any criticism whatever can be applied

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to the excellent papers comprising this symposium, it is that this point has not been sufficiently dwelt on. Each case must be studied and treated individually. Some of the chief causes of hemorrhage are myomas and carcinoma of the uterus, endometrial polyps, hypertrophic thickening of the endometrium, displacements, adnexitis, ovarian neoplasm, disturbances of the functions of the various ductless glands, especially the ovary, certain constitutional diseases, especially syphilis, tuberculosis, hemophilia, chronic liver and heart, kidney and lung disease, besides other less frequent conditions. When we consider the great number of diseases which may cause hemorrhage, the importance of accurate diagnosis is apparent. As an example of this I may cite a case in which I was recently asked to perform a curettage for hemorrhage on a patient suffering from syphilis. The pelvic examination was negative and the exhibition of neosalvarsan checked the hemorrhage very quickly. A curettage in this case would have been of no benefit. The constitutional disease was what required treatment. The treatment of myomas of the uterus with radium or Roentgen rays undoubtedly has a very definite place in gynecology. No one however skeptical can fail to be convinced by the excellent results reported by Drs. Kelly and Pfahler, as well as those by Krönig and Gauss and others. Personally, however, I doubt very much if the Roentgen rays or radium will ever supersede surgery in the routine treatment of uterine myomas. The extremely small operative mortality and the excellent postoperative results are strong arguments in favor of the surgical treatment, whereas the prolonged treatment required and the expense, as well as the somewhat less certain results, are points that must be considered before Roentgen-ray or radium treatment is selected. Another important point of practical value is that carcinoma of the fundus is occasionally and indeed relatively frequently an accompaniment of myoma of the uterus. In all patients suffering from hemorrhage at or near the cancer age it is our first duty to exclude carcinoma, and this is particularly true in those cases in which the pelvic examination is negative or reveals only a slightly enlarged uterus. Dr. Kelly, you will remember, has very properly performed a curettage for the purpose of determining this point as a preliminary step before instigating the radium treatment. In closing I would again urge the necessity of studying the etiology of each individual case, for only by so doing can the proper treatment be instigated.

Dr. John A. McGlinn, Philadelphia: So far as the nervous element of the bleeding from the uterus is concerned, it is not so much due to shock to the nervous system as it is to the result of the shock on some of the ductless glands. In the few cases following shock I have noticed other metabolic changes, such as falling of the hair and change in menstrual bleeding. Some time ago I sent out a letter to the members

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of the American Surgical Society asking whether in their opinion surgery could be eliminated in the treatment of fibroid tumors of the uterus. Eighty replied that positively it could not be. The same question was asked the Roentgenologists and eight out of 90 replied that it could be and that the Roentgen ray should take the place of surgery. I feel that we should not confuse the cure of fibroid tumors of the uterus with the relief of bleeding from fibroid tumors of the uterus. I have no quarrel with radium or with the Roentgen ray, but that surgery can be eliminated in the treatment of fibroid of the uterus I do not believe. I believe that even with the Roentgen ray and radium, surgery is still the best treatment. The mortality of surgery in these cases is due to the various complications present other than sarcomatous degeneration; so that, considering the mortality, it will be found that the Roentgen-ray treatment has not a great advantage over surgery, taking into consideration the ultimate cure. The reports given by Dr. Kelly are amazing. According to the reports gathered in the clinics in Europe, but 5 per cent. of the tumors entirely disappeared. That simply means that 95 per cent. of these tumors are in a condition to undergo complications which will bring the high operative mortality; whereas, if the cases were treated by surgery, even if 5 per cent. of the patients do die, at least 95 per cent. of the cases are cured against 5 per cent. cured by the Roentgen ray.

Dr. William S. Newcomet, Philadelphia: I am glad to know that when Dr. McGlinn sent out that little note, only eight out of one hundred roentgenologists decided that all tumors could be treated by the Roentgen ray. As a rule I think that roentgenologists try to be conservative, and this proportion shows well for our work. The work of Dr. Kelly and Dr. Pfahler shows that under these good reports was skill. No doubt the great trouble often in the matter of results is that many patients are treated by persons who do not understand how to use these methods. Furthermore, I am glad also to hear Dr. Kelly mention the fact that the Roentgen ray and the gamma ray are not to be regarded the same. It was twice stated in this meeting by men in other Sections that the Roentgen ray and the gamma ray are identical and that they can be used one for the other. Any one who has ever had any experience with the Roentgen ray and with radium and has seen the reaction from each, must be impressed with the entirely different process following the application of either of these methods. Also if you should have a burn or a reaction from the Roentgen ray in the same proportion as you have a reaction or burn from radium you would have a lifetime injury; whereas the reaction from radium will clear up in a very short time. It is a curious thing that abscess follows the destruction of tissue in these cases from radium. Dr.

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Kelly has referred to this, and I have seen it twice in my own experience. On the other hand, it is very rare to have abscess follow destruction of tissue from a Roentgen-ray burn. Dr. Kelly's results exceed any I have seen so far published. They far exceed those of the London Radium Institute, which I am in the habit of quoting because I think they are giveu from a very conservative basis. Another important point taken from Dr. Kelly is that his applications are directly on the tumor, while in the vast majority of cases treated by the Roentgen ray, the influence on the fibroid is from the reaction on the ovary. Curiously enough, it has been cited time and time again that in these pelvic cases treated by the Roentgen ray sterility usually follows. About ten years ago I treated for Dr. George Erety Shoemaker a patient with a large sarcoma of the pelvis about the size of a seven months' pregnant uterus. The woman recovered and became pregnant twice, the first pregnancy occurring two years after the disappearance of the tumor. The woman is now in good health.

Dr. Stephen E. Tracy, Philadelphia: Before we can intelligently treat a case of uterine bleeding it is necessary to make a diagnosis, and this is not always possible before operation. I cannot speak of radium, as I have had no experience with it, but I want to congratulate Dr. Kelly on the wonderful results. There are those who assert that all cases of carcinoma of the uterus and all fibromyomas of the uterus should be treated by roentgenotherapy, and I trust that Dr. Kelly in closing the discussion will state his position in this matter. Dr. Pfahler has designated what cases of uterine bleeding are suitable for roentgenotherapy, and I believe that most of us will agree largely with his statements. We all know that Roentgen-ray treatment for malignant disease of the female pelvic organs has been practically worthless. In regard to fibromyomas of the uterus, it is well known that malignancy is present in from 4 to 5 per cent. of the cases. Malignancy and the various other degenerations of fibromyomas of the uterus are found in 15 per cent. of the cases which come to operation, and such cases are not suitable for roentgenotherapy. When we add to this 15 per cent. the complications and associated conditions in the appendages, we have in between 30 and 35 per cent. of the cases conditions which would not be cured by roentgenotherapy. At least 25 per cent. of the women with fibromyomas of the uterus who have come to operation, would have perished, sooner or later, if they had been relegated to the roentgenologist. It is generally conceded that women under the age of 40 years are not good subjects for Roentgen-ray treatment. It has been clearly shown that after the age of 40 years the dangers of fibromyomas of the uterus increase with advancing years. In a collected series of approximately 700 cases I found that 70 per cent. of the degenerations took place in women after the age of 40 years, and

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that over 90 per cent. of the malignancies were found after that age. When all these facts are considered, the conclusion is inevitable that the best treatment for the majority of these tumors which produce symptoms is early surgical intervention, unless Dr. Kelly can cure them all for us with radium.

Dr. Curtis F. Burnam, Baltimore: I have been studying with Dr. Kelly the cases reported. I have seen them from the very beginning and therefore have taken a very lively interest in the foregoing papers and the discussions. I incline to believe that many cases of uterine hemorrhage are really dependent on uterine and not ovarian conditions. This view is partly substantiated by a series of cases in which I operated on young girls for hemorrhage; curettage having failed to relieve them, resection of the ovaries was finally resorted to. In spite of the reduction of the ovaries the bleeding continued. In one of the group intra-uterine application of radium brought about a return to normal menstruation after operation had failed. An interesting point in connection with all these cases is the frequent absence of menopausal symptoms when complete amenorrhea has been produced by the treatment. It is quite astonishing to interview a patient who gives no history of menstrual or other bleeding and yet reports not the slightest general disturbance. Proceeding to the therapeutic questions involved in these cases, I should like to be put on record with Dr. Kelly in asserting definitely that the ray treatment will perhaps entirely replace operative surgery and will certainly do it in most cases. The treatment itself is extremely simple, without danger, is not time-consuming, and in no way prevents going on later to surgical methods if it proves unsuccessful in any given case. I should like also to say in reply to one of the speakers, that the recent reports from Freiburg of mesothorium treatment in similar conditions in every way conformed to these results here reported. Gauss and Lempke state that in sixteen fibroids radiated, fifteen have entirely disappeared and one greatly decreased. I should like also to emphasize that the effects of radiation in uterine fibroids, as also in polypoid endometritis, and perhaps also in cases of metrorrhagia hemorrhagica should be on the tumor and uterus and not on the ovaries. So far as I know no one has treated a large fibroid tumor of the uterus in which the growth disappeared within a few months after radiation and the patient continued with normal menstruation up till the cases which we report. The efforts of most European roentgenologists have been directed toward devising technic to radiate the ovaries. It has been assumed that the effect on the fibroid is indirectly through the ovaries, although many have stated that there may be an effect on the tumor itself. Our plan is to protect the ovaries and radiate the tumor. Under radiation the tumor disappears rapidly; from ovarian ablation the disappearance is slow, extending over months and years. Radium has the advantage over the

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Roentgen ray because it is applied inside the uterus, affects directly the tumor and to a lesser degree the ovaries. It would seem easily possible, however, to devise a technic for the Roentgen ray which will radiate the uterus and not the ovaries. I am far from saying that in a very short time results as rapid and complete cannot be gained by the Roentgen ray as well as by the radium. In polypoid endometrium amenorrhea cases cessation of bleeding was brought about immediately from the day of the treatment.

Dr. George Erety Shoemaker, Philadelphia: I have a word to say on the subject of any treatment which leaves the tumor in the pelvis, when there is a tumor. The complications are often more important than the tumor and bleeding is the only one of them which may be modified by the Roentgen ray. Dr. Pfahler in his interesting paper mentioned that the question of malignant degeneration had been raised but that no case had been reported. I had the experience two months ago of operating in a case to be later more fully reported which had been under Roentgen treatment by a competent operator for fibroid tumor, but which later developed sarcoma. The whole treatment by other means than hysterectomy went through seven years, first, for a year by that active electrical treatment which we no longer hear about. Then the patient had Roentgen treatment twice a week for many months and the hemorrhage stopped, as it does in some fibroid cases. She still shows purplish spots in the skin over the abdomen, due to the Roentgen ray. After five years of cessation, her tumor increased in size, she began to bleed again, and her physician, Dr. Evans, sent her to me for hysterectomy. She had a fibroid tumor of the uterus with sarcomatous degeneration scattered in various parts through it. After years of treatment she had to have the operation after all. In Dr. Kelly's series of polypoid endometritis cases there is one confusing element. He says he curetted each one before the application of radium. Of course the curet alone will in good hands stop the hemorrhage in a certain number of cases. According to his table some of the patients had not previously been curetted.

Dr. George C. Johnston, Pittsburgh: Dr. Kelly states that he has taken the opportunity to bring this matter before the general profession through the medium of this meeting and through the medical press. In regard to the Roentgen-ray treatment of fibromas, I am surprised at the attitude taken by some of the profession. We roentgenologists do not want to treat these cases. Our position is this: we are engaged in our work, and in walks a prominent gynecologist. He says, "Don't you see what they are doing over in Freiburg?" We perfect our technic and devote ourselves to this work and then we are blamed for taking these cases. We do not want them, but if you men will not take them, we shall be obliged to. We

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will treat only those cases that are referred to us by competent gynecologists who say that in their opinion these cases are better treated at the hands of a competent roentgenologist than by the surgeon.

Dr. Emil Novak, Baltimore: In the present state of our knowledge it is unwise to be dogmatic as to the relative importance of the uterus and ovary in the causation of functional uterine hemorrhage. Even though it be shown that uterine bleeding is caused by a local factor in the endometrium, it seems probable that the presence of this factor is in some way due to the activity of the ovary. The assumption that there is a local physiologic disturbance in the endometrium would seem to explain why curettage will sometimes relieve uterine bleeding, even though the removed endometrium is microscopically normal. In these cases it is not unlikely that the cessation of the bleeding is due to the removal of the accumulated coagulation-inhibiting substance in the endometrium. As I stated in my paper, anatomic changes in the endometrium are often, no doubt, the result rather than the cause of menstrual aberrations. We must learn to look on the endometrium as a sensitive plate which registers the more fundamental phenomena of menstruation. Certain histologic changes are now recognized as characteristic of the normal menstrual cycle, and in the same way we must learn to appreciate that various histologic pictures, abnormal as to degree or time of appearance, may be encountered when menstruation is abnormal.

Dr. John M. Fisher: I want to ask Dr. Kelly whether the fibroid tumors were selected cases?

Dr. Howard A. Kelly, Baltimore: The fibroid tumors were not selected in this series. If I had any extensive abscesses or cancer of the body complicating the fibroid I would not use the radium, but would take any other case that came along. In hemorrhage cases and the fibroids with or without hemorrhage, the first thought is radium and not operation. Curettage was done at the time the patients were treated. Many of them had been curetted previously but unsuccessfully, or they would not have come into our hands for treatment for the hemorrhage. It is an entire innovation in our methods and in the matter of the benefit of the patient. The operative cures of sarcomas of the uterus are practically nil. In about 400 cases treated with radium and Roentgen rays in Freiburg there is no case on record with history of subsequent development of malignancy. In illustration as to the effect in sarcomas: A tall overgrown lad with a big tumor in the left abdomen comes for treatment. After treatment for several months, on examination nothing could be felt through the abdomen but a small mass through the rectum. Dr. Burnam took that out and it was found to be a testicle which had become sarcomatous. On the other side

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there were two fallopian tubes and a little uterus in between. In other words, it was a case of mixed sex elements. Something new has come into our midst and something big. We must take hold of it and see what comes of it. We are using radium every day for uterine hemorrhage, for fibroid uteri. We have radiated many carcinomas of the cervix uteri. In some cases we have later removed the uterus. In not one have we discovered any cancerous elements remaining. In one of them we found some of the pelvic lymphatic glands infected. In one case we found the glands enlarged at the operation. We have a very definite hope that we can follow these cases in a considerable series. A number of cases come to us with other ailments, such as Bright's disease, diabetes and carcinoma of the uterus, which cannot be operated on. Some have profound anemia; others tuberculosis. To all these cases radium comes as a great boon, which is going to be extended and which we hope to develop in this class of cases. It does not take such a large amount of radium that the slender pocketbook cannot afford it.

Dr. George E. Pfahler, Philadelphia: I want only to answer one or two points, one with reference to the disappearance of the tumor. I said that 75 per cent. of the tumors I had treated had disappeared, and so they have, and you must not forget that these quotations made by Dr. McGlinn are mostly based on the work of men of few years of experience. They have treated more cases than I have. The roentgenologists have been working for from eight to ten years, and that is the reason we can speak with a little greater emphasis than these men can, because the tumor continues to disappear long after the treatment has stopped. With reference to degeneration of the tumor, I inquired of the physician who treated the patient referred to by Dr. Shoemaker. The patient came weekly for treatment through the years when the treatment was much less developed than at present. He referred the patient for operation. Regarding degeneration of these tumors, it has been stated by men who know that 5 per cent. undergo malignant degeneration. If this is true, why have not 5 per cent. of those treated undergone degeneration? And if they have, do you believe that the physicians of this country have so neglected their duty that they will not call the attention of the profession to the fact that these tumors undergo degeneration later? Until we have definite data we have no right to assume that these tumors will undergo subsequent degeneration.

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FUNDAMENTAL INTRAPELVIC PERINEORRHAPHY

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Friedrich Schatz[1] in 1883, standing chiefly on the work of Luschka,[2] it appears, was the first gynecologist to point out in detail the anatomy of the female pelvic floor in general and that of the levator ani in particular, to define its functions and to describe the injuries which it receives, chiefly during parturition, in its posterior, lateral and anterior sections. He makes it clear that injury of the levator ani may occur independently of the perineum (submucous tears), but more usually with tears in the latter, and that truly intrapelvic work is needed to accomplish the best that can practically be done with them. The next most notable promotion of the subject occurred in 1889 by R. L. Dickinson,[3] who corrects some misconceptions of the anatomy and presents the results of tests of the contractile power and lifting capacity of the levator ani. The results of these tests I regard as necessarily due partly to the concurrent actions of the bulbocavernosus muscles and inner borders of the trigon, that could not be excluded.

Next, Charles P. Noble,[4] in 1897, published a method in which he made a modified Emmet denudation and passed interrupted sutures transversely, taking in the vaginal wound edges with those of the levators beneath, with the aim to attach the latter to the former rather than to unite the levator borders. After this,

1. Schatz, Friedrich: Arch. f. Gynäk., xxii.
2. Luschka: Das Becken.
3. Dickinson, R. L.: Am. Jour. Obst., September, 1889.
4. Noble, Charles P.: Am. Jour. Gynec. and Obst., April, 1887.

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in 1901, I[5] emphatically reiterated the superficial character of all the former standard perineorrhaphies and dwelt on the necessity of utilizing the more deeply seated but available portions of the levator ani and its fasciae, by true intrapelvic operating. I described and illustrated the various steps of an operation performed by myself for six years previously. During the past twelve years, most operators have obviously modified their former methods with an effort to engage the levator ani (with doubtful success), and a goodly number have abandoned their old methods entirely for a new and modern technic, professing to deal with the levator ani efficiently. While this has been achieved by some, in more instances it is evident from their descriptions and illustrations that they have mistaken some more superficial structures for the levator ani. This is one reason why I am again speaking on this subject, after a pause of thirteen years. A second is that recent and greatly superior anatomic studies and publications on the female perineum need to receive more general recognition, and a third reason is that the importance of the fasciae in the woman's perineum and pelvic diaphragm is recognized and emphasized by only few clinicians in their writings. The new and superior anatomic works referred to are by Halban and Tandler,[6] W. Liepmann,[7] Hugo Sellheim[8] and Edward Martin.[9] Waldeyer, Holl and Rieffel, whose authority is largely recognized in these newer studies, divide the female perineum and pelvic diaphragm grossly into three layers from within outward:

First, the principal part, a shallow funnel-shaped muscular layer (Fig. 4) composed of coccygeus and

5. Goldspohn, Albert: Am. Gyn. and Obstetrical Jour., June, 1901.
6. Halban and Tandler: Anatomie und Aetiologie der Genitalprolapse beim Weibe, Vienna and Leipsic, Braumüller, 1907.
7. Liepmann: Atlas der Operations: Anatomie und Operations Pathologie der weiblichen Sexualorgane, Berlin, Hirschwald.
8. Sellheim, Hugo: Deutsche Frauen-Heilkunde, I, Die Geburt des Menschen, Wiesbaden, Bergmann.
9. Martin, Edward: Der Haftapparat der weiblichen Genitalien, Berlin, Karger.

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levator ani muscles, is invested on the upper or visceral side by a layer of pelvic fascia, called fascia endopelvina by some and rectovesical fascia by Gray; and on its lower or peripheral surface by another layer of pelvic fascia called the ischiorectal or anal fascia by Gray, it having a connection with the upper sphincter. This main portion of the pelvic diaphragm is usually clearly shown in most anatomies and particularly in Figure 4. The levator ani is subdivided by some into the ischiococcygeus, ileococcygeus, pubococcygeus and puborectalis muscles. It is the latter that is chiefly engaged in plastic restoration of the injured pelvic floor.

The second layer, the urogenital diaphragm or trigon in the *male* perineum is clearly set forth in our general anatomies; but in the female perineum it is dismissed with a mere mention of a triangular ligament, but no proper conception at all is given as in the anatomic studies above mentioned (Figs. 2 and 3), that in the female there is also a virile urogenital diaphragm or trigon composed of two potent layers of fascia, the outer one being even aponeurotic, with the muscle of the urogenital trigon (or transversus perinei profundus) between them. This composite fascial and muscular plate, closing the pubic angle formed by the descending rami of the pubis and ascending rami of the ischium, reenforces the levator ani from below. Like the latter, it has a median urogenital aperture whose borders are firmer, more distinct and less yielding than are the borders of the genital cleft of the levator. It composes the trigon in the female perineum, and beneath it lie the subfascial (superficial) muscles—the superficial transversus perinei, the ischiocavernosus and the bulbocavernosus composing the *third layer* (Fig. 2). The bulbocavernosus, surrounding the vulvar opening, reenforces the inner margin of the trigon; and these together are what some operators have mistaken for the levator

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ani, whose anterior median edges lie farther within, are less distinct and extend more in an inward and upward direction. This mistake is apparent from the illustrations and described technic of Robert T. Morris,[10] Arnold Sturmdorf,[11] C. A. Hall,[12] George B. Somers[13] and C. W. Barrett.[14]

Edward Martin has made some of the best dissections and sections *en masse* of hardened female pelves under the direction of Waldeyer. Copies of some of his plates are here presented. He says, "The distinct edge which is felt in the vagina is not the levator edge, but the inner border of the urogenital diaphragm," that is, the fascial trigon. The levator ani lies beyond this structure farther within the pelvis, more like a curtain hanging down over the lateral bony walls of the pelvis. The needle or sharp volsellum that picks it and its fasciae up right will sometimes hook into the periosteum beneath it, and will then require releasing a little. These bilaterally receded parts of the levator that we need to bring together and unite in the median line back of the vagina and in front of the rectum always lie from 4 to 5 cm. or more away from the muco-skin junction, where the operation begins; and their efficient union requires that a flap of posterior vaginal wall be raised extending from that line inward at least 6 to 8 cm. and laterally near to the arcus tendineus or white line in the pelvic fascia. These deep-seated receded parts of the levator ani with its fasciae are best caught up on each side and drawn toward the median line preliminary for suturing, by curved volsellum forceps with semisharp teeth, so as to avoid puncturing hemorrhoidal veins unnecessarily, the rectum being held out of the way by the index-finger of the left hand.

10. Morris, R. T.: The Female Perineum from a General Surgeon's Point of View, THE JOURNAL A. M. A., May 18, 1912, p. 1508.
11. Sturmdorf, Arnold: Am. Jour. Obst., September, 1912.
12. Hall, C. A.: Surg., Gynec. and Obst., February, 1909.
13. Somers, George B.: Repair of the Perineum, THE JOURNAL A. M. A., Nov. 11, 1905, p. 1462.
14. Barrett, C. W.: Am. Jour. Obst., April, 1909.

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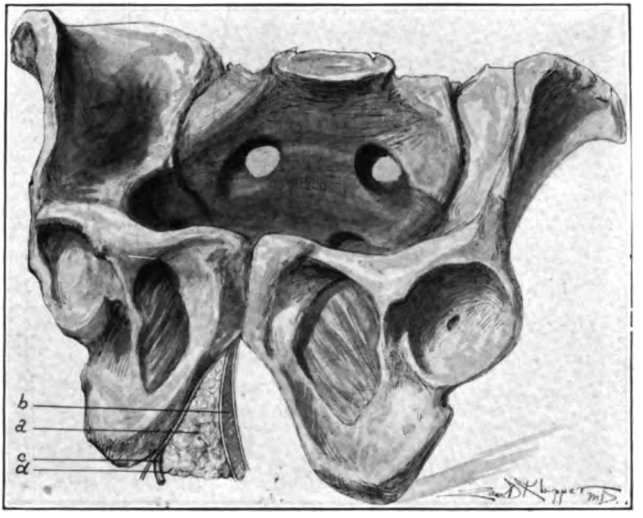

Fig. 1.—A drawing of a manikin constructed after illustrations by Gray and by Liepmann. A transverse vertical section of the ischiorectal fossa (*a*) and of the levator ani with its fasciae (*b*) is represented. The obturator fascia (*c*) and the internal pudic artery (*d*) appear on the lateral wall of the fossa.

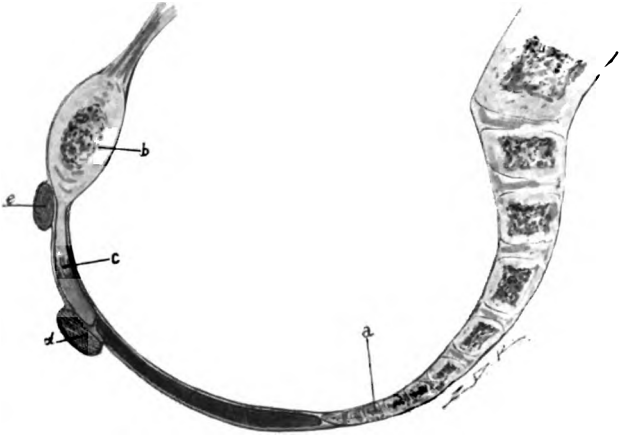

Fig. 2 (taken from Liepmann, Plate VI).—This drawing is made from an anteroposterior section on the left of the median line, and shows a section of the levator ani with its fasciae, as extending from the coccyx (*a*) to the symphysis pubis (*b*). It is reinforced in front by the urogenital trigon (*c*). External to this are sections of the superficial transversus perinei (*d*) and of the ischiocavernosus (*e*) muscles.

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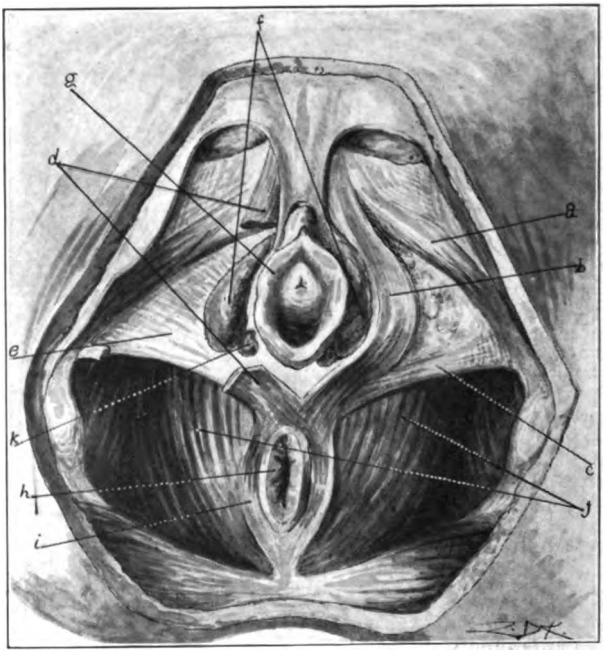

Fig. 3 (Plate 13 of Edward Martin's Atlas).—Labia, skin, subcutaneous fat, superficial perineal fascia and contents of the ischiorectal fossae removed. The ischiocavernosus (*a*), bulbocavernosus (*b*) and the superficial transversus perinei (*c*) muscles (belonging to the superficial perineal stratum) are intact on the left side; but the latter two are cut away (*d*) on the right side to expose the urogenital trigon (*e*) on that side. The bulbi (*f*), Bartholin's gland (*k*), vulva (*g*), and the anus (*h*), with the external sphincter (*i*), are intact. The levator ani (the innermost stratum) is divested of its outer fascia.

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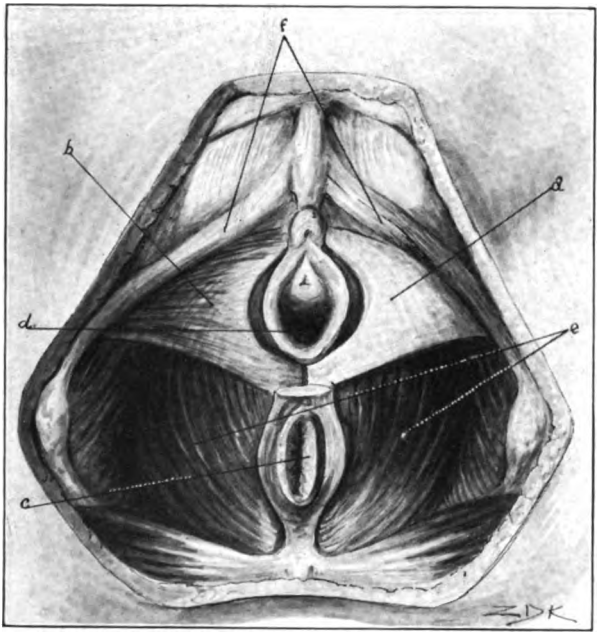

Fig. 4 (Martin, Plate XIII).—Chief muscles of the outer stratum or layer and the bulbi removed. The urogenital trigon (the middle stratum) composed of two layers of fascia with muscles between them, is intact on the left side (*a*), but has the outer aponeurotic layer removed on the right side, to show the fibers of the transversus perinei profundus (*b*) within. The anus (*c*), the vulva (*d*) and the levator ani (*e*) are intact as before. The crura of the clitoris (*f*) are shown, the left one in its relation to the ischiocavernosus muscle.

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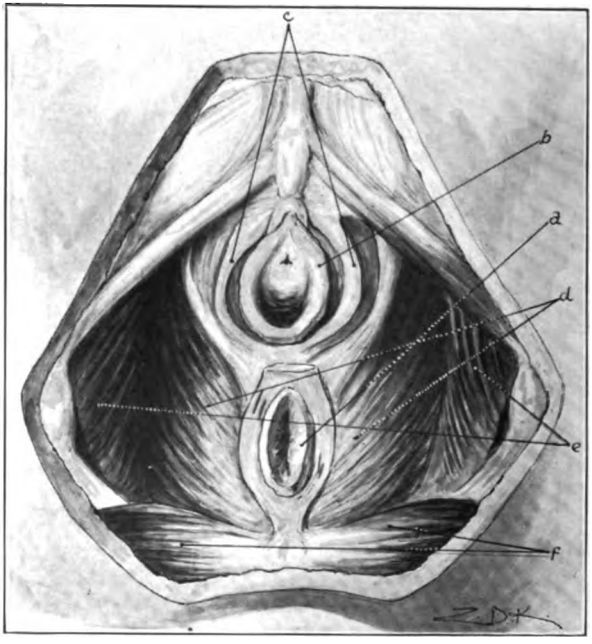

Fig. 5 (Martin, Plate XIV).—All the structures of the superficial and of the middle strata removed up to the margins of the rectum (*a*) and vagina (*b*), that have been carefully preserved, the latter as a projecting collar, which is surrounded by the remaining edge of fascial trigon (*c*). The ischiorectal fossae have been cleared out and the muscles composing their walls—the levator ani (*d*), the internal obturators (*e*) and the pyriformi (*f*)—have been divested of their fascial covering.

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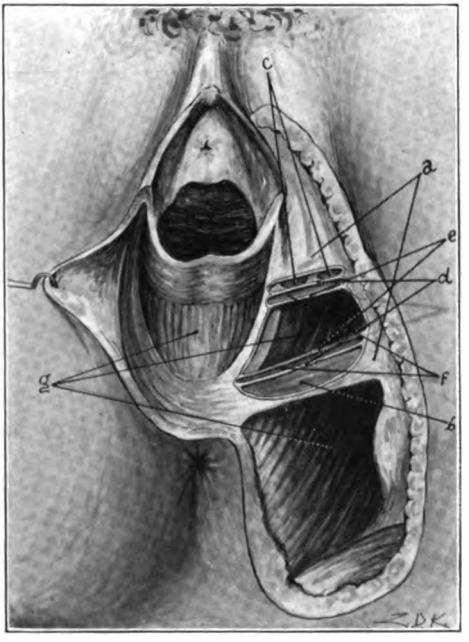

Fig. 6 (Martin, Plate XV).—Section showing the three main strata of the structures in the female pelvic floor, and the three layers of the trigon (middle stratum); *a*, superficial fascia; *b*, superficial transversus perinei muscle, and *c*, sections of bulbocavernosus and ischiocavernosus muscles, composing the outer stratum; *d*, the outer fascia (aponeurosis) of the trigon; *e*, inner fascia of the trigon; *f*, transversus perinei profundus muscle lying between these fasciae and completing the trigon (middle stratum); *g*, the levator ani, the innermost and chief stratum.

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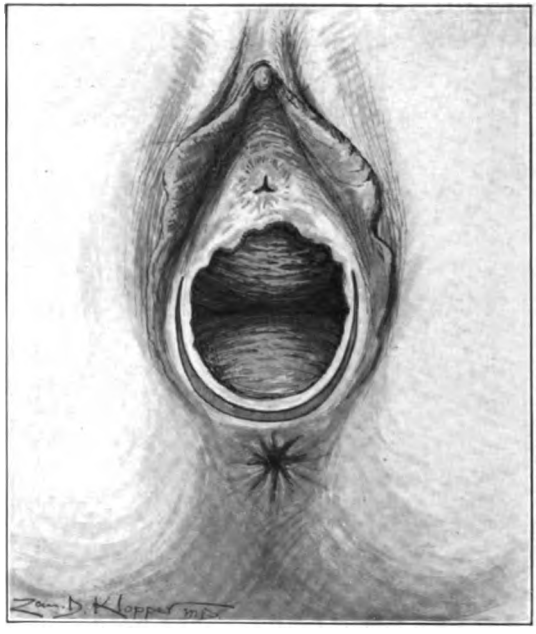

Fig. 7.—Line of first incision at the mucoskin junction.

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Fig. 8.—Method of raising the vaginal flap, its thickness being always noted and guided by one or two fingers of the left hand opposite the points of blunt or sharp dissection beneath. No such sharp-pointed scissors should be used.

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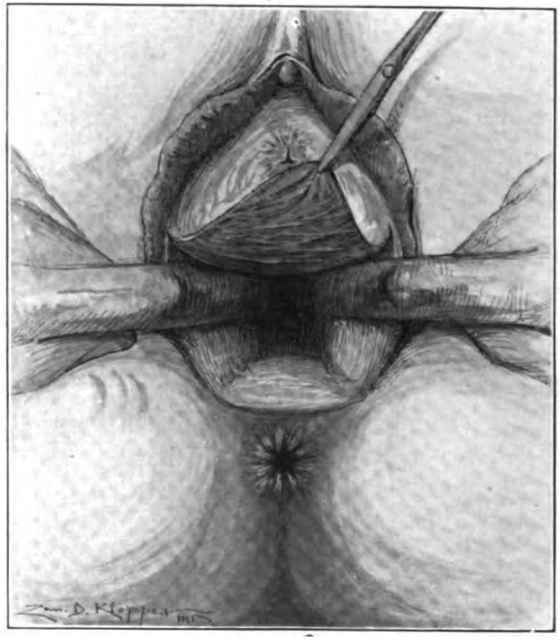

Fig. 9.—The posterior vaginal wall must be raised to a distance of from 7 to 8 cm. inward, and laterally to the level of the white line in the pelvic fascia of each side.

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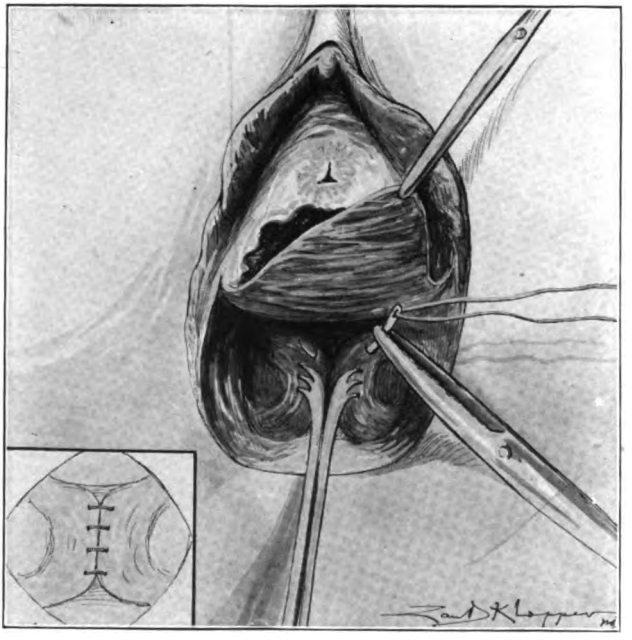

Fig. 10.—The corresponding portions of the levator ani with its fasciae are each caught up from the bony walls of the pelvis at a depth of from 5 to 8 cm. within, by a semisharp volsellum forceps curved sidewise. They are approximated and separately united near the median line, by three or four interrupted or continuous strong catgut sutures.

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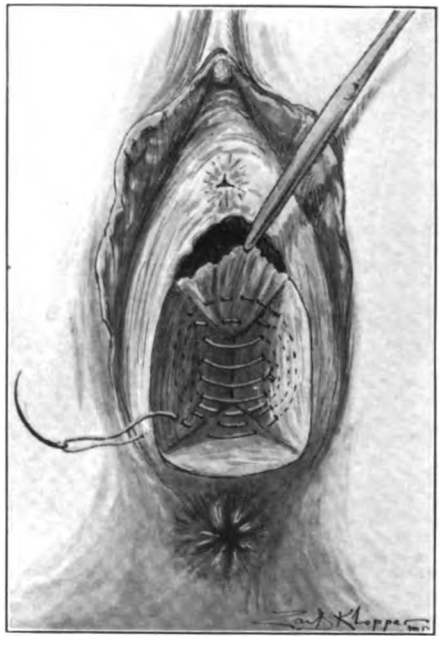

Fig. 11.—After the levator has been sutured separately, the remaining wound is closed from side to side, from within outward, by continuous catgut sutures passed circuitously and knotted at every third or fourth turn, and the skin wound is closed vertically by interrupted silkworm-gut sutures.

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Union of these parts thus brought into view is made by three or four turns of continuous or interrupted strong sutures of catgut chromicized or treated with formaldehyd, the third and fourth of which and all succeeding sutures catch enough of the areolar tissue over the rectum below and beneath the vaginal flap above to obliterate the dead spaces and to gather the broad vaginal flap into small anteroposterior folds and to fasten it sufficiently on top of the newly made bridge of levator beneath. The fasciae of the levator are really the most important part in the bridge, as its comparative inelasticity shows when it is thoroughly made. All of this bridge, if it is really composed of levator ani, will be within the pelvis beyond the more prominent and palpable ridges or strands that are commonly felt in the perineum passing up along the sides of the lower section of the vagina.

As the suturing of the wound continues from the bridge mentioned above downward, these inner edges of the fascial trigon, as the second layer in the pelvic floor, are also united, and likewise the bulbocavernosus and transversus perinei muscles (of the third layer) that should coalesce in the tendinous center of the outer perineum in front of the rectum. The technic of the operation in detail is shown in the illustrations. Suffice it to say that the buried sutures, whether interrupted or continuous (with a tie at every third or fourth turn), should not penetrate the vaginal flap, but merely catch into the submucous tissues beneath it. No figure-of-eight sutures should be employed anywhere in this operation.

In cases of complete tear through the sphincter ani, the operation, first suggested by a German for this injury, is first performed as follows: A shallow incision varying in outline between an inverted V and a semicircle is made from a little outside of the point of retracted sphincter end of one side to the corresponding point or sphincter end on the other side, and

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at a distance of from 1.5 to 2 cm. away from the edge of the tear in the rectum. From this curved line downward to the border of the tear a thin flap is very carefully dissected up without perforations, and turned downward over the cleft in the sphincter and rectum to protect all sutures from contact with the bowel lumen or its mucous membrane. The raw surfaces and exposed ends of torn sphincter are then brought and united together by interrupted catgut sutures, over the raw surface of the flap. It is well to place a silkworm-gut suture in the rectovaginal septum beyond the first incision to relieve the tension on the other sutures.

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CHIEF FACTORS IN FAILURE OF OPERATIONS FOR RETRODISPLACEMENT OF THE UTERUS

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This paper makes no pretense to novelty. It is just an emphasis on things said before. I like to ask "why," to dig up causes and to handle them with bare hands, and so I present just a few facts, recall a few failures and make a few suggestions.

First, the facts. They are alphabetic, but one needs initials to spell so big a word as "success."

I. ANATOMIC FACTS

The first group of facts is anatomic.

1. The normal uterus is a freely movable organ and is suspended in the pelvis between the abdominal cavity and the pelvic floor by the harmonious action of its several supports, that is, (*a*), the pelvic floor; (*b*), the adjacent pelvic organs; (*c*), the retentive power of the abdominal cavity; (*d*), the several ligaments, and (*e*), the normal relation which the uterine axis bears to the axis of the vagina.

In the erect posture of the woman, bladder and rectum being empty, the os externum is in the plane of the ischial spines, or a little below it and slightly posterior to a central position in the pelvis. The cervix projects into the vagina and is directed toward the last sacral vertebra, and is held in this position by the uteropelvic and the uterosacral ligaments, and the vesicovaginal fascial plate. The upper and posterior

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aspect of the fundus is at or a little above the level of the plane of the brim. The axis of the uterus is at nearly a right angle with that of the vagina, the body resting on the pubic (fascial) shelf.

The axis of the uterus has a wide range of inclination dependent on the degree of fulness of the bladder and rectum. With bladder and rectum moderately full the uterine axis conforms to the axis of the pelvis. With the bladder empty the axis of the vagina is almost horizontal and runs almost directly backward, while the uterus is directed forward at an acute angle and is in a position of marked anteversion, slightly anteflexed. The attachments of the uterus are for the most part of yielding character which allows great freedom of motion in all directions, rising and falling with the respiratory movements and changing its position with the different positions of the body. A full rectum pushes the uterus bodily forward and a full bladder displaces it backward.

The ligamentous supports of the uterus are the round ligaments, muscular bands covered with peritoneum which tend to hold the fundus forward, acting as "guy-ropes" to prevent it from falling backward.

The uteropelvic ligaments, which consist of bands of muscle-fibers running outward from the supravaginal portion of the cervix to the pelvic fascia within the base of each broad ligament, prevent the uterus from undergoing lateral changes in position and help to sustain it in its proper plane.

The broad ligaments, which act in some measure to steady the uterus in or near the median section of the pelvis, and the uterosacral ligaments made up of muscle and cellular tissue and covered with peritoneum, pull the cervix upward and backward and prevent its downward displacement.

The pelvic floor, which preserves the position and integrity of all of the organs and soft parts of the pelvis, indirectly supports the uterus. The pelvic floor,

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Fig. 1.—The normal uterus with regard to position, axis, and relation to surrounding viscera.

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Fig. 2.—Short anterior and long posterior invagination of the cervix with retroflexion of the fundus, and cervix in the long axis of the vagina.

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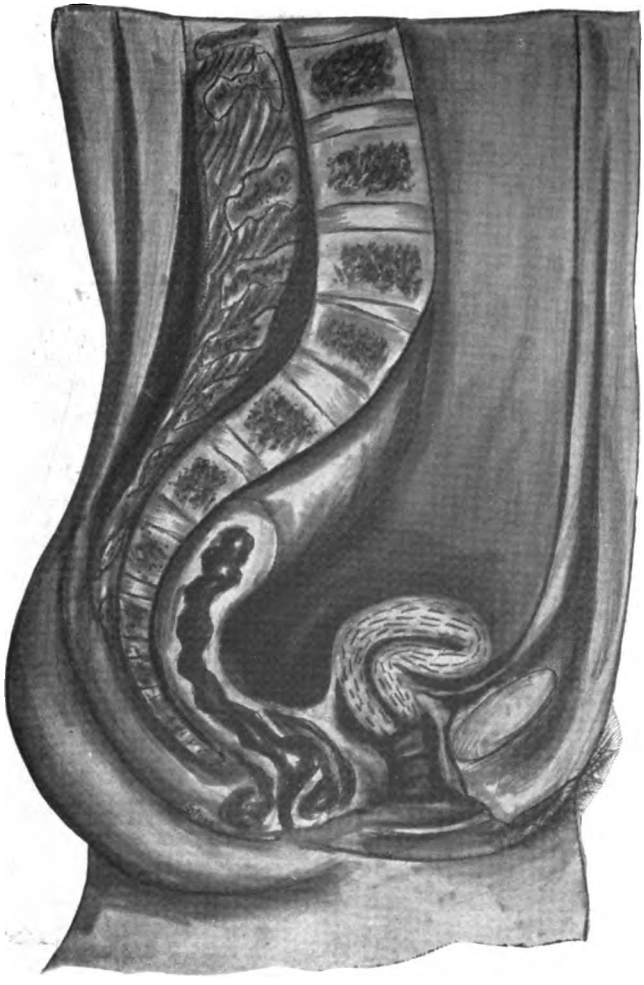

Fig. 3.—Effect produced by any operation done solely with the object of bringing the fundus forward into type of case illustrated in Figure 2.

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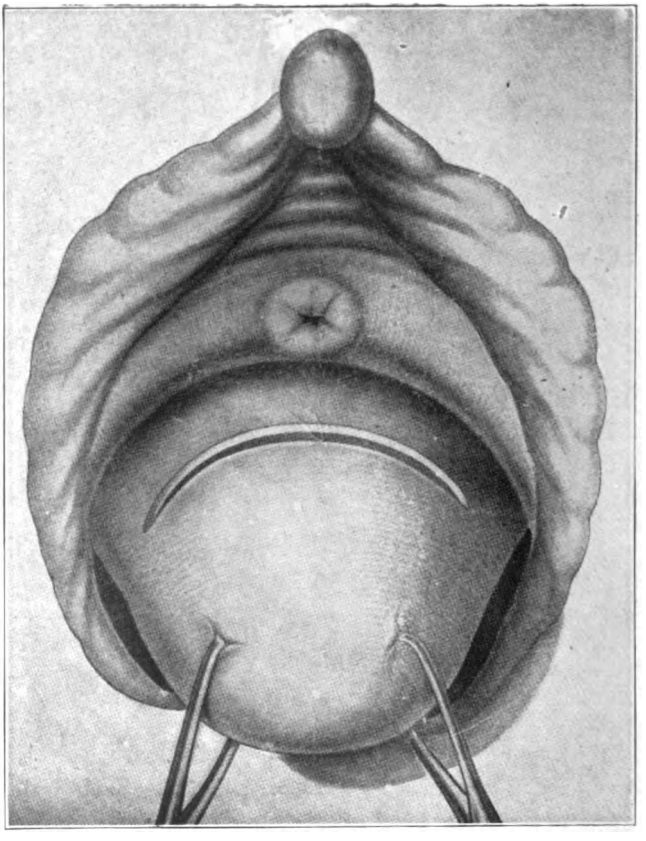

Fig. 4.—Cervix brought down and position of incision in Reynolds' operation.

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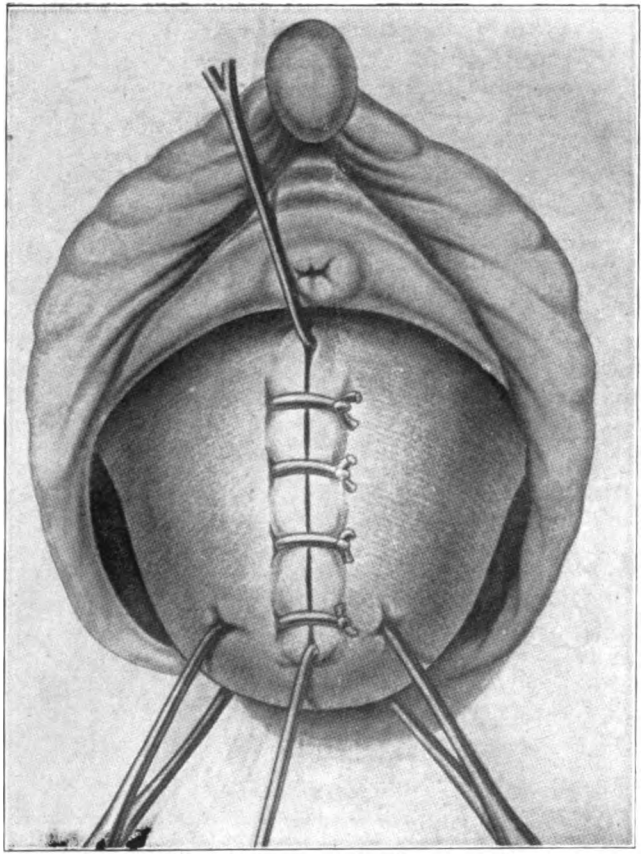

Fig. 5.—A longitudinal suture of the transverse incision shown in Figure 4.

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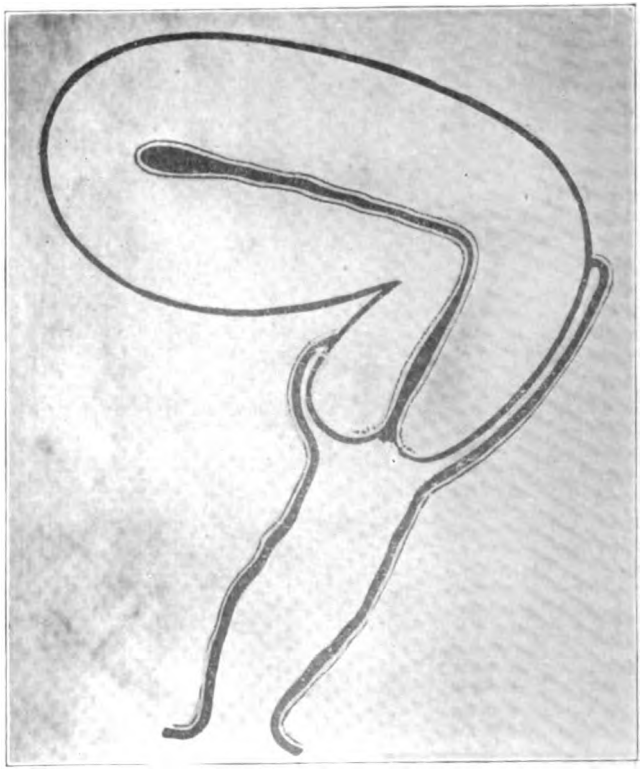

Fig. 6.—Acute anteflexion of the uterus with short anterior and long posterior invagination of the cervix; os in the long axis of the vagina.

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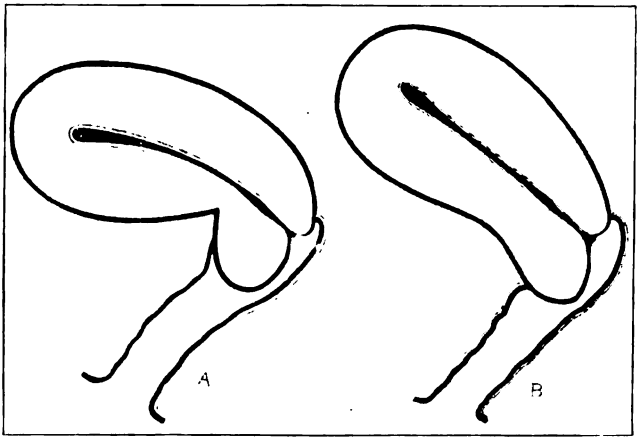

Fig. 7.—*A*, the effect of the Dudley operation on variety of uterus shown in Fig. 6. Cervix placed well backward and flexion still remaining in the interior uterine wall; *B*, effect of combined Dudley-Reynolds operation on variety of uterus shown in Figure 6.

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the uterosacral ligaments and the uteropelvic ligaments are the chief supports against downward displacement.

These facts are recalled mainly to rivet our attention on this fundamental fact—that nature has provided women with these ligaments and supports for certain definite purposes, and when such supports and position are at fault it is the duty of the gynecologist to determine before operation what are the digressions from the normal.

II. HISTORICAL FACTS

The second group of facts is historic. The pioneer work in this department of gynecology was done by Alquié about 1840. More than a quarter of a century afterward came Koeberle, 1869; Adams, 1880. The real work in this line, however, originated with Alexander, when in 1881 he performed his first operation, reports of which he published in 1884. In 1886, Kelly and Ohlshausen devised intra-abdominal operations for suspension of the fundus. Wylie, in 1886, intra-abdominally shortened the round ligaments for retrodeviation, and reported his cases in 1888-9; and in 1889 Freund shortened the uterosacral ligaments. More recently we have plication of the round and broad ligaments after the method of Coffey; also plication of the vaginal wall after the method of Emmet-Baldwin.

These were the pathfinders in our specialty, and although there have been a multitude who, since their work, have cried "lo! here" or "lo! there," I am persuaded that every procedure in operating for retrodisplacement is only a modification or adaptation of the procedure of one of these six primary methods.

III. FAILURES

And now as to the failures; but why speak of failures? Because, they are facts, big, bulky facts which ought not to be, and again because they are our most efficient if not our most delightful teachers. In the world of economics the word to conjure with to-day is "efficiency," and as we analyze the curriculums of

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the schools of commerce where this new science is being studied, we discover that the student is taught that waste is worth while, that every failure has a cash value. Let us liquidate ours and we have a goodly asset in this department of surgery. The proportion of failures was brought very forcibly to my attention at a recent meeting of the New York Obstetrical Society, at which time a symposium was held on "The End Results of Operations for Retrodisplacement within the Last Five Years," done by different notable gynecologists at the various hospitals in Greater New York. A summary of the results of this symposium is soon to be published in the *American Journal of Obstetrics*.

And now what is the cause of our failures? First, a plain neglect of the alphabetic facts of anatomy such as I have summarized above, a failure to take counsel with Nature's simple physiologic mechanics. Secondly, what might be called a passion for originality, in which the enthusiastic operator permits himself to be obsessed with his own idea to the forgetfulness of the work done by the pathfinders in our department.

The following points should be passed on before determining what shall be the operative procedure in a given case:

1. What is the age of the patient? If the woman is in the child-bearing period, no operative procedure should be undertaken which will cause any interference with pregnancy; whereas, if the woman is past the menopause, the simplest operative procedures which will hold the cervix upward and backward and the fundus forward should be undertaken.

2. What is the condition of the pelvic floor? It is trite to say that it is absolutely essential that a corrected or overcorrected pelvic floor of a firm muscular type, as for instance an Emmet-Holden, must accompany any operative procedures for retrodisplacement when there is a relaxed pelvic floor existing.

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3. What is the position of the cervix, and can it be replaced up in the hollow of the sacrum? It has been interesting within the last year or so in Dr. Polak's Clinic at Long Island College Hospital, to see the number of cases in which we have not, on discharge of the patients from the hospital, found the uterus in an anatomically perfect position. On investigation we have almost universally satisfied ourselves that the reason for such disappointment has been that we had a cervix which did not go backward when the fundus has been brought forward by the operation which we had selected for the given case, and on further observation we are satisfied that in these cases we have not achieved the desired result, because we did not appreciate the fact that there was a congenital short anterior invagination of the cervix which prevented it from taking its normal position, even though there was a firm pelvic floor and the fundus was brought well forward. Such cases we have time and time again seen recur. It is the information gained from this particular type of case which stimulated me to thought with reference to failures, and if possible by analysis to minimize my own failures.

Reynolds, in his original article "Anteflexion of the Cervix and Spasm of the Uterine Ligaments in Relation to Retroversion, Dysmenorrhea and Sterility," dated May, 1911, read before the American Gynecological Society, called attention, in connection with the treatment of sterility, to the advantage to be gained by lengthening the anterior vaginal wall and thereby allowing the cervix to be placed in normal position. I am of the opinion that Reynolds' article has not received the attention of which it was worthy, and so the facts of his procedure have not been appropriated to the correction of retrodisplacement of the uterus. With this idea in view I have tried to emphasize the advantages to be gained by the Reynolds' operation in conjunction with other operative procedures. I say advisedly that long ago the pioneers in this department

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of surgery laid it down as primary that, it matters not how far forward or by what method the fundus is brought anteriorly, cases will recur if the cervix is not placed upward and backward in the hollow of the sacrum, and my own observation goes far to commit me unqualifiedly to the same conclusion.

To be practically specific and illustrate the reasons for frequent failure, I mention the following complications and failures in some of the well-known methods which we have used:

1. The Webster-Baldy operations: Two tubal pregnancies due to angular constriction of the tube in its isthmic portion arresting the impregnated ovum in its transit to the uterus.

2. Lateral version of the uterus, due either to unequal primary development of the ligament, present but unnoticed or unappreciated at the time of operation, or to torsion of the ligament from defective technic.

3. Large ovaries slung over the encircling band formed by the round ligaments tend to fall low in the pelvis by lengthening of the utero-ovarian ligament, and become adherent to the posterior surface of the uterus or broad ligament.

4. The sigmoid may become adherent to the ligamentous loops, causing left-sided pain and digestive disorders.

5. The ligaments passed behind the uterus may become edematous from constriction and offer an inflammatory surface for intestinal adhesions.

6. Ovarian enlargement as a result of venous stasis of the broad ligaments.

7. A large uterus may sink in the pelvis through the encircling ligamentous loop and the ovaries are carried upward and to the median line and thereby become adherent to one another, forming a sensitive mass on the posterior wall of the uterus.

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In the 437 Webster-Baldy operations performed by Polak and his associates, twenty-six patients had thrombosis of the pelvic veins, which had extended to the femoral and saphenous. The type of cases in which we have used this operation successfully is that in which there is a small uterus and two well-developed round ligaments.

Coffey plications of the round ligaments have been followed by the following complications: exudates in the uterovesical space and painful uteri with limited motion. Dyspareunia has been one of the chief complaints.

In the two cases in which the abdomen was reopened the pathology was interesting; in one the uterus was prolapsed and hanging from the anterior vaginal wall by two ribbon-like bands, the round ligament was not appreciable, being similar to those bands found after simple ventrosuspension, while in the other case the uterus was buried in adhesions.

This operation is useful in covering over raw surfaces on the anterior uterine wall after myomectomy, etc., in conjunction with a uterus which tends to sag backward.

The chief objection we have found in the operation is that it brings the whole organ forward in the pelvis yet does not exaggerate the anteversion and subsequently the cervix slides up under the symphysis followed by the backward displacement of the fundus.

We have had a number of failures by the Gilliam, and the Montgomery-Gilliam, for the reason that the cervix is not carried up into the hollow of the sacrum.

When prolapse is associated with retrodisplacement in a woman near or at the menopause the transposition operation has been very satisfactory. The Emmet-Baldwin plication of the anterior vaginal wall has been done very seldom but is considered a very satisfactory procedure because it places the cervix well backward and upward.

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IV. CONCLUSIONS

It is obvious that I have only gleaned in the field which stretches to the horizon of surgery, but this much grain may be gathered from what I have gleaned.

1. The gynecologist must be strong in the grace of discriminating; he must receive as alphabetic the proposition that the cervix must be placed upward and backward in the hollow of the sacrum.

2. No one operation already devised or to be devised will cure all sorts and conditions of cases. As individual as is the patient, so individual may be the patient's displacement, and this element of individuality must be seen clearly and bulk large in the operator's diagnosis—hence, the absolute necessity for the fundamental grace of discrimination.

I beg leave to report a personal interview which I had with an operator of note two years ago, at which time I asked the following question, "Do you do your operation on all cases of retrodisplacement of the uterus?" and the answer was in the affirmative.

The gynecologist must possess in a great degree the grace of self-elimination. The passion for spurious originality must be brought to heel like a well-broken dog. In my opinion the six procedures recalled in the historical survey, with the addition of the Reynolds operation in those cases in which a short anterior invagination of the cervix exists, present a sufficient number of points of departure for, loosely speaking, every case. Given an intelligent appreciation of the essential element in each one of these six alphabetic procedures one is on the line of approach to the cure of every case.

3. Adaptation, modification and synthesis. Having made his selection of the main procedure it remains only for the operator to apply that procedure which with its individual modifications is called for by the case before him. The opportunity for modification is infinite, as various as the cases themselves. The modification may consist of an exclusive use of one of the

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main procedures, or by synthesis of the whole or part of two or more of the main procedures. In short, success in this particular operative field, and that must always mean success for the individual patient, is to be achieved by an unqualified commitment to fundamental anatomic facts, by elimination of self and by adaptation of existing procedures to individual cases by a process of modification and synthesis.

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ABSTRACT OF DISCUSSION

ON PAPERS OF DRS. GOLDSPOHN AND HOLDEN

Dr. George R. White, Savannah, Ga.: Our failures in these cases, whether they be of retroversion or prolapse—the two conditions are very closely associated—are because we do not take cognizance of Nature's methods. I disagree with Dr. Holden in placing the emphasis on the anatomic parts. It has been mentioned that the perineum supports the uterus; the uterus stays up as well when the perineum is cut through. The uterosacral ligament is not much of a factor in uterine support. The emphasis should be placed on the uteropelvic ligaments, the so-called cardinal ligaments. The easiest way to do the operation is to make a small incision in the broad ligament, opening it up fully and putting in a retractor. Down under the cellular tissue of the broad ligament are the supports of the uterus. The tissues here are strong and firm and will hold during pregnancy. Operation is done in different ways, by the Hirst, Polk and other operations. All of these operations are good and either can be done if the ligaments have not broken loose by a difficult delivery and become contracted in the side of the pelvis. To get at them one must come down over the broad ligament and pull them out until reaching firm tissue; then use them where they belong. On that line I believe we shall make our advance in the treatment of retrodisplacement and prolapse.

Dr. H. Grad, New York: I was glad to hear Dr. Holden's paper because it deals with the failures. Dr. Holden referred to the papers on Retroversion of the Uterus, which were written for the New York Obstetrical Society, and I had the pleasure of looking up the operation for retroversion in one of our hospitals. I found that at the Woman's Hospital about 800 women had been operated on in five years. Only a small number of these could be traced. The studies of the cases that could be traced showed that no matter what method of operation was employed for the uncomplicated cases of retroversion, success was obtained in about the same

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proportion of cases. Anatomic results were obtained in a large number of cases. The symptomatic results in the Alexander operation were about the same as in the Gilliam operation, almost the same as in ventrosuspension. It seemed to make little difference what operation was done in the uncomplicated cases of retroversion. It makes no difference whether one plicates the round ligament or cuts the broad ligament and stitches it together, they all give about the same result. The trouble comes when complications enter, when the cervix has fallen down, when the cardinal ligaments which Dr. White spoke of have retracted and allowed the pelvic floor to sink. In these cases failures will follow. A large proportion are due to the fact that the anterior wall of the vagina is short, as Dr. Holden pointed out. Here we must treat the complications. Dr. White said that the uterosacral ligaments did not give much support to the uterus. This may be true, but when one utilizes them in operations they give good results. About three years ago Dr. Jellet of Dublin published reports of twenty cases in which the uterosacral ligaments were used. Since that time we have been using the method of shortening the uterosacral ligaments in complicated cases in which the pelvic floor has been split and with excellent results. It is of first importance, therefore, to distinguish between lacerations of the perineum and of the pelvic floor, as laceration confined to the perineum is always a laceration in the median line. If superficial it will give rise to but few or no symptoms, but if deep enough it will separate the transversus perinei muscles which coalesce at this point with other muscular structures and by retraction of their torn ends will cause a gaping vulvar orifice. When, as is usual, both of these anatomic structures are involved, the laceration of the perineum being central and that of the pelvic floor lateral, it is of first importance to make the dissection not alone within the vagina to restore the pelvic floor, but likewise to carry it down low enough so that the retracted transversus perinei muscles can be included with the overlying fascia and sutured at the same time the pelvic floor is repaired. Dr. Goldspohn's work first led me to realize the importance of the levator ani muscle and the splitting of the fascia, bringing both together by separate suture. In this connection it is likewise well to bear in mind that in the process of labor, as the head is projected down into the vagina, it quite frequently pushes in front of it a cuff of the vaginal mucous membrane. This means that a detachment of the vagina from the subadjacent structures has taken place. I have seen this in cases of complete prolapse of the uterus in the presence of a good pelvic floor. The important thing to do after restoration of the pelvic floor in such a case, is to reattach the vagina to the sutured levator muscles.

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Dr. John M. Fisher, Philadelphia: Dr. Goldspohn very properly calls attention to the fact that in order to appreciate the symptomatology and clinical significance, as well as the operative procedure adapted to the proper repair of the pelvic floor, it is of first importance to have a clear conception of the anatomy of the parts. Evidently he has not read the article on Diseases of the Vulva and Vagina in Keen's Surgery, volume 5, in which I described minutely the very thing to which he calls attention, the triangular ligament, or as I term it, the vaginal septum. In the study of vulvovaginal injuries we must take into consideration this triangular ligament in its relation to the muscular structures of the vulva. If this is not done, especially in operating on the pelvic floor alone when there has been laceration of the perineum in addition, we still have to deal with a gaping vulvar orifice.

Dr. C. M. Echols, Milwaukee: A word about the Reynold's operation which Dr. Holden has had occasion to do. I have been looking for indications during the last year to do this operation but very rarely have found a suitable patient, especially among multiparous women, who constitute the majority of patients on whom we have to operate. Most of these women I have to operate on have a little tendency to cystocele, and the Reynold's operation is contraindicated in all such cases.

Dr. John A. McGlinn, Philadelphia: In the matter of the history of the operation referred to as the Reynolds operation, Dr. B. F. Baer of Philadelphia did this operation at the same time as Dr. Reynolds, and I feel that it really deserves to be termed the Reynolds-Baer operation.

Dr. Channing W. Barrett, Chicago: Dr. Goldspohn and I agree that the importance of this question lies in the fact that perineal work is in the developmental process instead of a finished condition. He laid stress on the inefficiency of many of the standard cardinal operations, and I agree with him thoroughly. Dr. Goldspohn did pioneer work some years ago, but he stopped by getting deep enough, and then, instead of isolating muscles and fascia—and he gives the reason for that—he left it at that point, closing by side to side sutures. I emphasize the point that this is mural work, dealing with the lower wall of the abdomen, and that it is hernioplasty. Several years ago, having a condition of this kind, I devised a procedure of making a longitudinal incision posteriorly and closing it transversely.

Dr. Brooke M. Anspach, Philadelphia: The attention which has been given in recent years in perineorrhaphy to the dissection and coaptation of the actual fibers of the levator ani muscle and the deep layers of the pelvic fascia, has undoubtedly improved the results of the operation. In all operations of this type, it is desirable to place some sutures

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in such a fashion that the anterior wall of the rectum is drawn well up toward the cervix. Dr. Ward of New York has laid stress on this point. It is undesirable in these operations to remove any more than a minimum amount of the vaginal mucous membrane. If the vaginal mucosa is extensively removed in the denudation and dissection preceding the introduction of sutures, the redundancy of the vaginal wall which nature has provided in the vaginal sulci is lost, and a repetition of the laceration in subsequent childbirth is almost inevitable.

Dr. Albert Goldspohn, Chicago: I am convinced that many gentlemen who are not dealing with the levator ani in their operations think that they are. They are honest about it but they are mistaken. While Dr. Barrett may now be going deep enough to seize the levator, he has repeatedly mistaken the inner edges of the trigon and bulbocavernosus muscle as the levator ani muscle in his illustrations. Edward Martin says in his new Atlas, *"Haftapparat der Weiblichen Genitalien"* that this is a common clinical mistake. With regard to the remark of Dr. Fischer, concerning the article in Keen's Surgery, no proper conception at all is there given of the urogenital trigon—a three-ply structure—as constituting the most tangible, the middle stratum, of the female perineum. Waldyer's division of the female pelvic floor and perineum into three strata, makes the anatomy much clearer. What has been mistaken, by many operators for the levator ani, is the prominent vaginal edge of the fascial trigon (of the second stratum) reenforced by the bulbocavernosus muscle. These two together can be felt as a firmer structure than the levator ani ever is, at both sides of the vaginal entrance to the pelvis; but they lie more superficially, about in a plane extending between the pubic rami and only about 2 to 3 cm. from the skin border; while the levator lies within the pelvis, more laterally and at twice that depth.

In retroversion work we should choose methods that are anatomically correct. Any procedure that consists in doubling up the thick uterine end of the round ligament in the shortening process, and then depends on the terminal frayed-out useless peripheral end of the ligament to do any holding, is anatomically irrational; not only because the round ligament is so diminutive there, but also, it has no attachment or anchorage outside of the parietal peritoneum, except areolar tissue in its curved course to the inguinal canal. It will yield indefinitely to any pull that is sufficient to dislodge the parietal peritoneum. The Webster-Baldy and the Emil Ries' operations, therefore, I regard as inconsistent on anatomic grounds. Very much better are attempts to get at and to cross the sacro-uterine ligaments in front of the cervix, by way of the vagina. Retroversion is most efficiently dealt

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with by some transplantation of the round ligament into the abdominal wall, in some one of ten or more different ways. Even in cases in which perhaps it is not ideally the best thing theoretically, practically it is the best thing, because we make use of the thick end of the round ligament to do service; and because this type of operations has borne a good clinical test.

Dr. Frederick C. Holden, New York: My main object was to emphasize the importance of the proper selection of cases and of operations. Many men are doing one operation in all cases. They may not know that they get failures, but I think others find them. I would say to Dr. McGlinn that I did not mean to rob Philadelphia of any of the glory in the Wylie-Baer operation. I knew that Drs. Wylie and Baer were doing this work simultaneously, but I believe Dr. Wylie was the first to report his results. We do not do the Reynolds operation in the presence of cystocele.

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PELVIC VARICOCELE

WILLIAM EDGAR DARNALL, A.M., M.D.
ATLANTIC CITY, N. J.

The subject of pelvic varicosities is little discussed, little understood and little written about. It is, however, of sufficient importance to be the cause of considerable suffering among women. Pelvic varicocele or varicocele of the broad ligaments consists of a more or less permanent dilatation of the veins of the pampiniform plexus. The condition is not so uncommon as has been supposed. There are few operators of long and extensive experience who do not come across cases of this kind in their gynecologic work, yet the literature on the subject is exceedingly meager. The first case reported in this country was that of Dr. Dwight of Boston in 1887. A. P. Dudley and Zinke of this country have written exhaustively on this subject. Dudley reported four cases, Malins of Birmingham found two more and to these Zinke adds two cases. Rousans states that it is quite common. Winkel, cited by Reed, found the condition present only ten times in 300 necropsies. I have operated in ten cases during the past year.

We must remember that there is a reason for almost every physical discomfort if we can but run it down, and there is a reason for the child-bearing woman who vainly goes from one physician to another with aching pains in the pelvis and back, dragging sensation worse on standing and walking and worse at the menstrual period, and suffering from all the symptoms of pelvic engorgement and pelvic irritation, although the examining physician may not be able to palpate anything on physical examination on which to base a diagnosis.

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By reason of a failure to find anything tangible, the woman is often assured that there is absolutely nothing the matter and is in the mind of her doctor consigned to that large class of neurotics with magnified imaginary symptoms which center in the pelvis.

The anatomy of the uterus shows that the utero-vaginal plexus of veins extends over the walls of the vagina, and as an especially close plexus along the lateral margins of the uterus, collecting the blood from the uterine veins which surround the uterine artery, and forming broad anastomoses with the pampiniform plexus of the ovarian veins.

The causes of varicocele of the broad ligament are more or less obscure. These veins may become very much enlarged in pregnancy. This enlargement may be due to some form of obstruction to the return circulation due to the position of the organ, wearing tight clothing, etc. It was my rare privilege recently, during an operation for cesarean section, to observe just how large these veins may become. The patient was a young negress of 24 with a justo minor pelvis. The usual operation for cesarean section was done, and when the abdomen was entered, the right broad ligament presented a worm-like tortuous bunch of veins, the main trunk being as large as the index-finger. It is easy enough to imagine that after delivery when the involution of the uterus is not perfect there may be a failure on the part of these overdistended veins to regain their normal size and tone just as often is the case with the long saphenous vein of the leg.

The condition most often prevails in women who have borne one or more children, and especially if the perineal supports from below have been impaired and the woman has suffered from a sagging down of the pelvic organs. It may, however, occur in single women who have retrodisplacements of the uterus and who have been compelled to be on their feet a great deal.

Other causes may be a relaxed condition of the tissues from a low state of health, heart- or liver-

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diseases, habitual constipation or uterine displacements. Some of the intestinal displacements, by angulation of the mesenteric veins, may materially interfere with the visceral circulation and be a cause. Dudley thinks that the left broad ligament is more frequently affected than the right by reason of the fact that the spermatic or ovarian veins being of such length, the weight of such a column of blood has a tendency to weaken the vessels. The left vein also empties into the renal vein at right angles to the blood-current of the kidney, and therefore obstructs the flow of the blood from the ligaments into the general circulation. It must also be remembered that there is an absence of valves in the uterine veins.

Zinke thinks correctly that intra-abdominal pressure from any cause should be added to the list and that often the condition results from some direct or indirect traumatism, such as external violence, frequent application of the forceps during labor, repeated abortions and operation on the cervix and pelvic organs, and to this Bandler adds infection.

Affections of the ovaries and other gross pathologic lesions of the pelvis are of course a very prolific cause of pelvic varicocele. It is not this class of cases I wish to discuss, but only the cases without such lesions. In these more serious conditions of ovarian cystomas and other palpable new growths, operative interference is indicated anyway, and as a matter of fact the symptoms are so masked by those of these serious conditions that diagnosis could not be arrived at, and can be made only in the absence of such lesions.

The kind of cases of which I wish to speak are those of the miserable women who come to you with dull irregular boring neuralgic pain in the abdomen and pelvis, which may sometimes reach a state of intense severity. The pains are usually aggravated by standing or walking and grow worse as the menstrual epoch approaches. There is a feeling of weight and

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dragging in the pelvis and all the manifestations that accompany pelvic engorgement and irritation. The women may menstruate profusely and sometimes every two or three weeks.

These patients suffer severely at times, and vainly seek relief at the hands of the physician, who on examination can find nothing to explain it. The result is that the symptoms are attributed to hysteria, which term covers a multitude of the sins of ignorance. Often the suffering of the woman assumes such proportions that in these days of kinks, pericolic membranes and displacements, the abdomen is opened for the purpose of finding out what is the matter and with a preconceived idea that there must be crops of adhesions or some undiscovered ovarian cause for the distress of the patient. Inspection of the pelvis, however, may show an entire absence of adhesions, kinks or membranes and that the appendages are without disease. If the veins of the broad ligament are not inspected, the abdomen may be closed without finding the real cause of the trouble, and without relieving it.

The diagnosis will depend on the symptoms outlined above combined with the *absence of any gross pathologic lesion* and the evidence of pelvic engorgement. It is necessary to elicit an accurate history of the character of the pain. If it is worse on standing or walking or as the menstrual period approaches, and particularly if the symptoms disappear as soon as the recumbent position is assumed, it is pretty apt to be due to varicocele, and especially so if the patient has borne a child. The mucous membranes of the cervix and vagina may assume a bluish tint similar to early pregnancy. If to these symptoms are added the loss of support from the perineum below with a certain amount of sagging of the organs, there can be little doubt about the diagnosis. The diagnosis of this condition must be made by exclusion, as must the diagnosis of all complaints which depend on clinical symp-

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toms alone rather than on the tangible findings of physical diagnosis.

All medical treatment is only palliative at best. Temporary relief may be secured by raising the level of the organs by tampons or a pessary and rest in the recumbent position. Surgery, however, is the only means of cure in these cases. The abdomen is opened and the veins should be ligated at both ends and in the middle and freely cut across between the ligatures. Excision of the veins is essential to secure their collapse and to prevent their restoration after the absorption of the ligatures.

The following typical cases are reported. The diagnosis in each of these cases but one was made before the operation and confirmed at the operation.

CASE 1.—Mrs. J. R. S., a young society woman aged 26, weight 150 pounds, well developed, was referred by Dr. H. T. Harvey. She was never sick until after her children were born; family history negative. She has had two children, no miscarriages, headaches are frequent and her present trouble dates back to the birth of her last child. Her menstrual periods are regular and painful, last four or five days, but her pain is very much relieved after her period. She has profuse leukorrhea. She sleeps well; appetite and digestion are good. Vaginal outlet slightly lacerated; bilateral laceration of the cervix. The uterus is normal; there is no ovarian or tubal trouble palpable and no bladder trouble. The appendix was removed some years ago by Dr. Joseph Price. She came seeking relief for most intense boring pain in both inguinal regions but worse on the left side. No diagnosis could be made on physical examination other than the lacerations of childbirth, but from the clinical symptoms a diagnosis of varicocele of the broad ligament was arrived at. The lacerations were repaired. The abdomen was opened and all of the pelvic organs were carefully inspected; there were no adhesions; the tubes and ovaries were absolutely perfect; but each broad ligament showed a knotty worm-like mass of varicose veins. These were ligated at both ends with linen and the abdomen closed. Eight months afterward she reports she never felt better in her life and has not a pain or ache.

CASE 2.—Mrs. G. J. was operated on eight years ago for a cyst of the broad ligament on the right side. Her father and mother died of carcinoma. She is 41 years old; her

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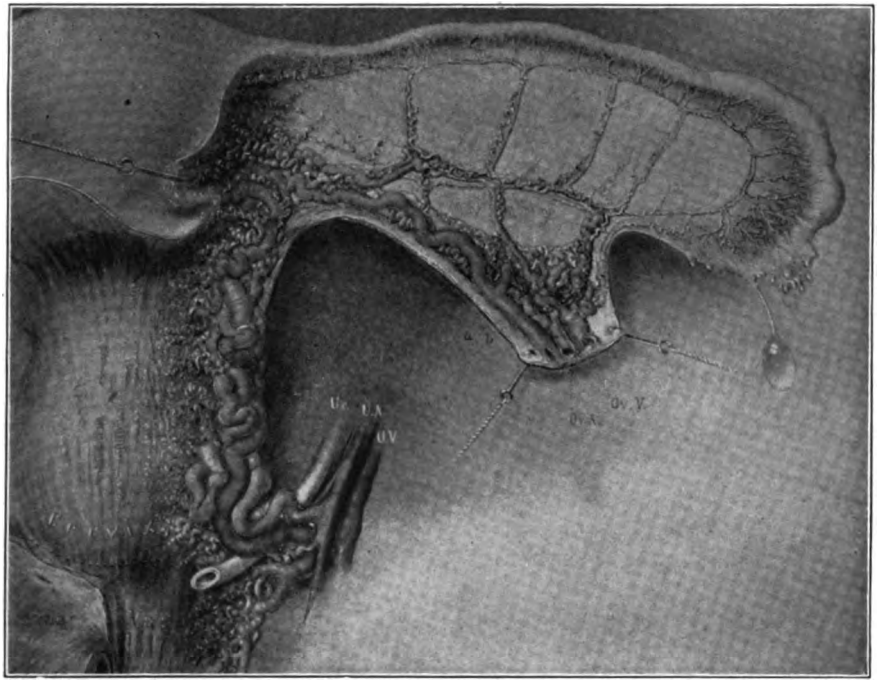

Section of cervix and broad ligament, showing enlarged veins. *Ur.*, ureter; *U. A.*, uterine artery; *U. V.*, uterine vein; *O. A.*, ovarian artery; *O. V.*, ovarian vein.

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appearance is anemic, her weight 105 pounds. She has had two children, no miscarriages. Leukorrhea present. She has headaches, sleeps well, appetite and digestion good, bowels regular. She complains of suffering boring pain on the left side, and menstruates profusely every two weeks. There is no palpable trouble with the remaining left ovary or tube. At operation a thorough inspection of the pelvis reveals no adhesions, no diseases of the tubes or ovaries, but a mass of varicose veins in the left broad ligament. Several weeks after her operation, she reports herself perfectly well and without her usual pain and discomfort and is gaining in weight.

Case 3.—Mrs. B. B. F., aged 30, married and referred by Dr. Mary Townsend. Father died of pneumonia. She is of a neurotic type, anemic, weight 115 pounds. She has had four children and one miscarriage. Leukorrhea present. Her menstrual periods began at 13 years of age and are painful and profuse, appearing two or three times a month. The vulva is normal; she sleeps well; appetite good and bowels regular. She has very severe lacerations of the vaginal outlet and cervix, the uterus is normal, ovaries normal, tubes normal, bladder normal and there is no palpable disease of the pelvis on physical examination. At operation the pelvis was thoroughly inspected and no palpable disease discovered except a small hydrosalpinx of the left tube, but she had present varicose veins in both broad ligaments. Three months after the operation, she reports herself free from pain and suffering and in good physical condition.

Case 4.—Mrs. M. L. H., referred by Dr. H. C. Monroe of Pleasantville, aged 24, anemic, weighs 119 pounds; father and mother living and well; patient has had two children and one miscarriage. Leukorrhea is present. Headaches are frequent, backache sacral. Patient sleeps well; appetite and digestion good, bowels regular. She began to menstruate at 13 years of age; periods are regular and without much pain; the vulva, vaginal outlet and cervix are normal. There is no palpable disease of the appendages and the uterus is in good position. She complains of severe pain, worse in the left side and more severe on standing or walking, but relieved on lying down, which is suggestive. The family physician feels that she has chronic appendicitis. When the abdomen is opened the appendix is fixed at the tip with a small adhesion and is slightly kinked but otherwise normal. There are in each broad ligament bunches of varicose veins. The tubes and ovaries are normal with the exception of a small graafian follicle cyst of the left ovary about the size of a hazelnut. The veins on each side were ligated and excised. This operation was only a month ago and too soon to report results.

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CASE 5.—Mrs. O. S., referred by Dr. C. Garrabrant. Family history good, married, aged 41, never been seriously sick, general appearance anemic, has borne no children, no miscarriages, no leukorrhea. Has headaches, back aches, intensely neurotic in type, appetite fair, digestion poor, sleeps fairly well, constipated, vulva, vaginal outlet and cervix normal, there is no palpable disease on physical examination of the appendages, menstrual periods are regular and associated with very severe pain which is worse on the left side and worse when she is on her feet. Diagnosis, pelvic varicocele. Opening of the abdomen revealed no pelvic disease with the exception of a few adhesions between the left broad ligament and the sigmoid, but varicose veins more pronounced on the left side were found. On account of her age and the hysteric type of woman, it was thought better judgment to make assurance doubly sure, and a subtotal hysterectomy was performed. Eight weeks after operation, she reports herself relieved of her pains and is gradually getting her strength.

CASE 6.—Mrs. L. S. aged 33, referred by Dr. E. C. Chew, family history negative, was never seriously sick; is anemic and thin and has been suffering for a year or more. She has had no children, no miscarriages, sleeps fairly well, appetite and digestion poor and is constipated. Headaches are frequent. Leukorrhea is present. The menstrual periods are intensely painful, the pain being much aggravated at that time. The vaginal outlet and cervix are normal; uterus, tubes and ovaries show no palpable disease on examination. There is some tenderness over the appendix and some irritability of the bladder. At operation the appendix is found to be normal. There is a graafian follicle cyst of the left ovary. The left broad ligament contains varicose veins. The ovary and the veins were removed. One year afterward she reports herself entirely well.

ABSTRACT OF DISCUSSION

DR. LAURA BRANSON, Iowa City: I believe that the importance of the broad ligament has long been underestimated. While I agree with Dr. Darnall that pregnancy is one of the most general causes of the lesion of the broad ligament designated "Varicosity," yet I also say that menstruation plays the same rôle in the formation of this varicosity although in a very much modified degree, because I consider menstruation a miniature pregnancy and although the after-effects may take longer time to become known, yet these are really as important as those caused by pregnancy. I believe that the diagnosis is arrived at only by exclusion. Since giving a great deal of attention to the study of gall-stone lesions, and noting how surgeons in operations on the abdom-

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inal cavity for other conditions have discovered gall-stones, it has seemed to me that we have been furnished more effective means of diagnosing gall-stone lesions. I have felt that our best diagnosis of this lesion must depend on similar efforts by surgeons in their work on the pelvic cavity, and that therefrom, in the course of time, we shall have definite symptomatology by which we shall be able to diagnose these lesions more accurately. I observed the case of a nullipara aged 28. Her abdomen was opened for supposed adhesions five years after an operation for appendicitis. No adhesions were present, but when the surgeon was about to close the abdominal cavity, in the prolapsed broad ligament there was found a soft fluctuating mass 2.5 cm. long and 0.75 cm. in width where the vein with its undisturbed circulation should have been. This was dissected out, the abdomen closed and in the year following the patient suffered none of the symptoms which she had previously had, those of pain in the iliac region, distress on standing, pain and sensation of fulness lessened on assuming recumbent position, and menstrual disturbance. This patient never having been pregnant, the case confirms my opinion that these pelvic varicosities may follow pathologic menstruation, although it may take a long time for the accumulated effect to be known. This may also prove that the symptomatology may be arrived at through surgical work on the pelvis.

Dr. J. H. Carstens, Detroit: The cases I have seen have always been in connection with some pathologic condition. They do not seem to me to be very common. I have seen a couple which I found afterward without having diagnosed the trouble, but these cases all have some kind of trouble for which you operate; so really the end of the whole subject is that there are certain cases in which the symptoms are very obscure and in which you cannot find any enlargement of the veins in the vagina. Usually the only symptoms are pain and a sense of dragging and other symptoms, which require exploratory operation. I think the pathology is the same as in varicocele of the man; it is a matter of anatomy in which there is apt to be enlargement of the veins.

Dr. S. M. Miller, Peoria: This subject is far more important than we have considered it to be. I have run across the condition a number of times at operation when it has not been previously diagnosed. I have a number of times confirmed the condition at operation when only a tentative diagnosis had been made. I seldom have had the temerity to make such a diagnosis *per se* because the condition was accompanied by no definite symptoms except one mentioned in a German publication.

It has been remarked that, if the patient is examined in the upright position, the veins of the vaginal plexus may be

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felt as a doughy mass. Dr. Kanavel of Chicago and I brought this to the attention of the medical profession eight or nine years ago in the *American Journal of Obstetrics*, dividing it into two classes, the primary and the secondary. By secondary we mean those cases which follow other pelvic lesions and are commonly found accompanying the condition. In that event the treatment would not resolve itself into ablation of the veins, but would be applied to the primary condition. It is usually accompanied by other complicated conditions than the cause of the varicose veins. I have seen an almost hard, white, small, friable, cystic ovary which I believed to be the result of varicosity of the vaginal plexus. This is not proved but would seem to be the solution of the small cystic fibrous ovary with varicose veins in the vaginal plexus. The pain may be of two varieties: pain on standing, aggravated at the periods, and pain in the ovary itself. These small ovaries with cysts are painful; pain is present at any time; this is an end-result. The proportion of primary to secondary cases is one to ten. The large number of secondary is due to pelvic relaxation. In illustration, I operated on a primary case in a woman who had no pregnancy and who was sterile. These multiple cystic fibrous ovaries, the result of varicosity, will result in sterilization. I had been able to find nothing in examination of the woman. She had had a painful left ovary. At operation this was obliterated with the broad ligament. Pain and tenderness have now recurred in the right ovary. The condition I believe is very often overlooked at operation because it is more emphasized with the patient in the upright position than in the Trendelenburg position, and unless one is looking specifically for the condition it will in many cases be overlooked. I have treated the condition in two or three ways, in some cases entirely obliterating the ovary, tube and broad ligament; in others, I have sectioned the broad ligament; still others, I have quilted under the broad ligament and the fallopian tube, and then further down have repeated the quilting. Mere ligation at one point will not correct the condition. The treatment has been successful, but difficult because it cannot be accomplished without troublesome hemorrhage from these freely bleeding veins.

Dr. Hugo Pantzer, Indianapolis: I have found this condition dissociated from other active causes in two or three cases only; these impressed me with its importance. The first case, reported in the early nineties before our local gynecologic society, was that of a woman in whom I found a large doughy mass on the right side and felt that it was owing to some ovarian circulatory disturbance. When I next saw the patient in bed I failed to find anything. The next time she came to my office, and the mass was again found on examina-

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tion. The diagnosis of pelvic varices was then made. The patient died of typhoid fever shortly afterward. I have not operated on any of my cases. I would regard the sclerotic ovary as rarely a cause, if ever, of pelvic varices.

Dr. Swithin Chandler, Philadelphia: Twelve years ago I examined a bladder and noticed on the left side much congestion. I was unfamiliar with this condition, and wrote to several men concerning it. I think it was Dr. Kelly of Baltimore, who suggested that probably there were enlarged veins on the left side, which would occasion this condition of the bladder. On that suggestion I opened the abdominal cavity and found the condition mentioned. There are three different phases of the question: diagnostic, complications during the operation, and the condition after an operation. The symptoms which Dr. Darnall has detailed are quite classical. It seems to me that this paper should go broadcast in order that the general practitioner may realize that this symptomatology is not merely a part of a woman's nervous and hysterical condition. I saw a man operate on a case in which the diagnosis had been made of a tear in the cervix and an enlarged ovary. The abdomen was opened, the cavity explored and nothing seen. The operator then sewed up the cervix and left an enlarged vein, which I am sure is going to give trouble. In the after result the cases should be carefully watched. In one case of enlarged veins I did a Baldy operation. That is the only operation I know that will hold up the uterus and the ovary and bring a perfect gravity situation into play. The woman was thoroughly relieved. Had the veins been larger I would have done what Dr. Darnall has described, and it might have been wiser, but the patient was entirely relieved. I believe so firmly in the Baldy operation that I took a chance and the operation was successful.

Dr. E. Gustav Zinke, Cincinnati: A peculiar circumstance happened some years ago. The patient was about 35 years old, and the mother of two children, both prematurely born, with a history of persistent bleeding throughout the entire period of pregnancy in each instance. When I was first called to see her she was pregnant apparently six weeks and she bled quite profusely; because of this I put her on her back. The os was not open, the cervix not obliterated, and there was no other evidence of miscarriage except the hemorrhage. It was hoped that by rest and the application of an ice-bag the hemorrhage might be arrested and abortion prevented. She continued to bleed, however. I therefore curetted and packed the uterus. After removing the gauze at the end of forty-eight hours she was apparently free from hemorrhage. Next day she was bleeding again and this continued in a greater or less degree for four or five months. As she became gradually exsanguinated something had to be

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done. The abdominal cavity was opened for diagnosis as well as any necessary treatment. I had no idea that she was pregnant still or I should not have opened the abdomen. When I opened the abdomen the entire pelvic cavity was filled with a mass of varicose veins, and out of the center appeared a flaccid, transparent cyst, which appeared to me to be parovarian. My first impulse was to remove that cyst. I pulled it out of the abdomen with a pair of forceps, when it contracted and became as firm as a cricket-ball. The forceps were promptly removed and a warm sponge was placed where the forceps had been until the hemorrhage ceased. The uterus was then dropped back into the abdominal cavity, the wound was sewed up and the patient went nearly to the end of her term, giving birth to a living child which seemed perfectly well. She has not had a pain or ache since. I do not know what has become of the varicosities; they could not be felt afterward. Whether they existed merely because of the pregnancy, I do not know. The case is one which cannot be explained. I have never been satisfied concerning it.

Dr. W. E. Darnall, Atlantic City: Dr. Zinke's case is exceptional. Ordinary one would have expected his patient to have had much pain and discomfort. What became of the pelvic varicosities which he did not remove, it is hard to say. Dr. Carstens says he does not find these veins except with other gross pathologic lesions. Perhaps if he looked for them more carefully he would find them. I think we surgeons, particularly, get into the habit of neglecting clinical symptoms and depending too largely on what we can palpate, while the clinical symptoms are relegated to a remote corner of our diagnostic brain. I have a feeling that Dr. Miller is right about the complicating conditions being a result rather than a cause of varicose veins, but of course this is rather hard to prove. My experience coincides with his that the patient refers the pain to the ovary and is so firmly convinced that she has ovarian trouble that she will ask for an examination, and if the examiner tells her her ovaries are all right she will often go to some one else, feeling that from the pain she suffers she must have some affection of the ovary which the first physician could not discover. Varicose veins can rarely be palpated and then only in the standing position, but the diagnosis can be made from a careful study of the history and the clinical symptoms.

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VESICO-VAGINAL FISTULA AND RECTO-VAGINAL FISTULA

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This article is necessarily in large degree a recapitulation of my surgical studies carried on during a series of years, reports of which have been published from time to time.

Soon after returning from my medical studies during 1869 and 1870 in the University of Berlin, it was my exceptional good fortune to become the student of J. Marion Sims of New York. Much of his operative success was dependent on his rare skill in the use of silver wire as a suture. Even to this day I suppose he is best known by its successful application as a suture in the cure of vesico-vaginal fistula — a success attributed by himself to the great value of silver-wire sutures. Mere reference to the monumental labor of Dr. Sims for the cure of this distressing condition is sufficient here, since every surgeon is familiar with it.

The first cure effected by him was only after thirteen previous operations. These repeated experiments were made possible, first, by his indefatigable persistence, and second, by the fact that a slave woman, who was rendered practically valueless by her affliction, and who had little to say as to the desirability of the operation, was his subject. The cure was effected only after four years of repeated failures.

Dr. Sims[1] reported this case in 1852. It was the beginning of a long series of most remarkable contributions to gynecic surgery. The study of this case

1. Sims, J. Marion: Am. Jour. Med. Sc., January, 1852.

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led him to devise the Sims speculum, first improvised on occasion by using a large iron spoon, the handle of which was bent to a right angle with the bowl. I have always been at a loss which to admire most — the wonderful inventive genius, or the very uncommon surgical technic displayed by this most original surgeon. For a long period I endeavored only to imitate, never venturing to modify, or hoping to improve on any of his operative procedures. This contribution of Dr. Sims furnishes in itself little that is especially new or important.

Dr. Hayward[2] of Boston published an elaborate article in 1839, and so far as I have been able to learn, he was the first operator, at least in America, to report a cure. He said:

"I introduced a bougie from the urethra through the fistulous opening with the patient in a lithotomy position. I incised the whole of the cicatricial tissue about the orifice and dissected the membrane of the vagina about half an inch away from the wound. This was done, partly to present a large surface and partly to prevent carrying the needle through the bladder. Three interrupted sutures were tied tightly and each thread was left about three inches long."

In 1851 Dr. Hayward[3] reported that he had performed the operation twenty times, but it was done on nine patients only, one being operated on six times, another five, two twice and five once.

In 1847 Dr. Pancoast[4] of Philadelphia reported two successful cases. He attributed the cure largely to what he called a "tongue-and-groove" method of coaptation of the freshened surfaces. One side of the wound was split, separating its surfaces for about three-fourths of an inch. The opposite side was pared to fit and the four raw surfaces were firmly held in apposition by sutures which were allowed to remain for two weeks. A catheter was retained in the bladder with frequent irrigation.

2. Hayward: Am. Jour. Med. Sc., August, 1839.
3. Hayward: Boston Med. and Surg. Jour., April 16, 1851.
4. Pancoast: Med. Examiner, May, 1847.

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In 1847 Dr. John Peter Mattauer of Virginia published his method for the cure of vesico-vaginal fistula, using lead for suture material. He advocated its advantages in three ways:

"First, the means which I use in exposing the vagina. Second, the introduction of a new suture which lies embedded in the tissue for an indefinite period without cutting its way out as do silk ligatures. Third, a self-retaining catheter." He reported six successful operations.

For an indefinite period of the past, metallic sutures have been used for a great variety of purposes. In my edition of Percival Pott — London, 1763 — the use of gold and lead wire is described in operations for the cure of hernia. Dr. Pott states that metallic sutures, both gold and lead, were used by Albucasis and others as early as the eleventh century.

It is hardly just to speak of Dr. Sims without simultaneous recognition of the admirable ability of his colaborer, Dr. Thomas E. Emmet. The specially curved scissors bearing the name of the latter were devised for the purpose of dissecting away the posterior protective layer of the vagina for the cure of rectocele and for the reconstruction of the perineal structures. The extraordinary skill of Dr. Emmet in the use of these scissors was noteworthy. He would dissect back and forth, denuding the whole posterior vaginal wall by the removal of a single unbroken strip, as the practiced housewife pares an apple.

Probably no subject pertaining to gynecic surgery has been written on by a larger number of contributors, expressing a greater variance of opinion, than the treatment of vesico-vaginal fistula. The difference of judgment has been in large measure due to ignorance of the anatomy and physiology of the pelvic floor in woman.

Both Sims and Emmet considered the silver-wire suture the important factor contributing to cure in diseases of this region. This was doubtless owing to

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the fact that nearly all such wounds were in greater or less degree subject to septic infection.

My old friend, Dr. E. W. Jenks of Detroit, called my attention in 1880 to his modification of the Sims-Emmet denudation. As he then explained his method, it consisted of a preservation of the posterior mucous membrane of the vagina, holding it as a flap for the protection of the wound from uterine and vaginal secretions. In his article,[5] Dr. Jenks describes his operation as follows:

"I use neither tenaculum nor tissue-forceps, but with the part tense, snip a hole in the mucous membrane in the median line, close to the integument, and then inserting the scissors with a cutting motion into the hole made, I continue to dissect the mucous membrane away from adjacent tissues without removing the scissors, first going up the septum as far as desired and then laterally, first on one side and then on the other, without removing the scissors, or once bringing their points from beneath the mucous membrane. Then, with blunt scissors, I cut away the dissected flap."

In putting his technic into effect, I soon learned that he was doing better than he knew, in that he separated the thinned-out posterior vaginal muscle from its adjacent structures. Not only was this easy of accomplishment, but also ready access was given thereby to the ruptured, separated, transverse muscles, and to the greatly enlarged and weakened *levator ani*. The retention of the separated portion of the vaginal muscle made it possible to make and maintain an aseptic wound and to restore the sundered parts by buried, continuous, absorbable sutures.

As a natural sequence, this process greatly simplified and assured safety in the cure of recto-vaginal fistula, by suturing the bowel wound and the vaginal opening separately. The operation for the restoration of the perineum was thus reduced to its simpler factors. In the publication of this operation in 1907, I described it as follows:

5. Jenks, E. W.: Am. Jour. Obst., 1879.

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"In recto-vaginal fistula, the perincal structures have usually been so greatly injured that it is better to divide at once what may remain of the *sphincter ani* muscle. The separation of the vagina and the rectum must be widely made, devitalizing the structures as little as possible. The first step of the operation consists of refreshing the old cicatricial portion of the rectal wound. These edges must be coapted with especial care. I prefer the double shoemaker's stitch, with eye of the needle near the point, using a fine, carefully selected tendon. The suture is inserted a quarter of an inch above the upper angle of the wound, and the stitches are taken with extreme care to include the coats of the intestine, excepting of course the mucous membrane.

This line of suture coapts and turns toward the bowel on either side a full quarter of an inch of the well-vitalized structure. The suture is continued externally to include a part of the sphincter muscle. The ends are left long temporarily, the better to secure control of the structures in the subsequent steps of the operation. The divided vaginal tissues are sutured in precisely the same manner. This having been completed, the final steps of the operation are the same as those for the restoration of the perineal tissues when uncomplicated by rectal fistula."

The admirable operations devised by Dr. Sims for cystocele left little room for improvement. I shall never forget his enthusiastic description of his procedure. He said:

"My primal purpose was to resect the lower segment of the protruding bladder [cystocele]. To my astonishment, on cutting away the greatly thickened structures, I found my wound was limited to the hypertrophied anterior vaginal wall, and that the bladder could be easily separated from it. I thought these structures of sufficient strength, by a careful coaptation, and by holding in place for a considerable time by silver-wire sutures, to effect a cure. You can judge of my delight when I found such restoration was usually permanent."

In the further study of cystocele in conjunction with my researches on the cause and cure of hernia, I found the cystocele not seldom dependent on injury to the floor of the pelvis, producing a hernia of the bladder. To effect its cure, I separated much more widely the anterior vaginal wall from the bladder, in order to gain free access for the restoration of the strong anterior pelvic fascia. The ease which the

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separation gave for a free manipulation of the bladder itself was a surprise.

An extended series of cases of wounds of the bladder within the pelvis, in which a careful closure with absorbable animal sutures enabled me to secure a perfect cure in every instance, led to the deduction that wounds of the bladder in the lower pelvic strait might be subject to similar easy cure. The technic is delicate, but had been equally well devised by the great masters already quoted, emphasis being laid invariably on the importance of never permitting the suture entirely to penetrate the viscus of the organ.

Here again, the buried absorbable suture proved indispensable. I soon learned that the fine properly chromatized kangaroo tendon was a very important factor of success. Applied with a fine needle, without cutting edges, the eye near the point, set in a handle, it is not difficult to coapt the wound accurately with a continuous suture and reinforce it with a second layer, daintily adjusting the external wall of the bladder over the first line of sutures. This effected, the anterior wall of the vagina is carefully sutured and a catheter retained for a certain period. I have had the remarkably good fortune to secure primary cure of vesico-vaginal fistula at the first operation in every instance. I attribute it to the fact that the wide separation of the fundus of the bladder puts the parts at complete rest, as the contraction of the vaginal muscle can have no part in producing tension on the sutures. This conclusion is worthy of special emphasis, since I consider it of basic importance as the especial factor of cure. The through-and-through suturing of both the bladder wall and the vaginal muscle includes important parts having different functions, the contraction and expansion of which are necessarily on different planes. It was a great surprise to me at first that bladder wounds on the intraperitoneal portion have from time immemorial been the *bête noire* of the profession.

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If my conclusion is correct, the operation above described claims the careful consideration of the profession. In a paper[6] on this subject before this Section of the American Medical Association in June, 1907, I wrote as follows:

"In the surgery of the bladder from within the abdomen, I was at once impressed by the ease and certainty of repair, giving in every instance a rapid cure. This led me to the conclusion that the pelvic portion of the bladder wall was difficult to repair only because of its close attachment to other structures having different functions. On this account the wound cannot remain at easy replacement and rest—essential factors of cure. I obviate this complication and reduce the problem to its simple factors by separating the bladder wall broadly from its attachments from below and close the wound of the bladder with a fine, double, continuous, buried tendon-suture, inverting and supporting the structures by a second layer. The vaginal wound is then closed by a continuous buried suture. A catheter is retained for some days in order that the structures may remain at rest. Of course, there are no stitches to be removed, and when the wound has been made and retained aseptic, cure is to be expected."

The aseptic coaptation of tissues, alike in structure and function, is of primary importance and should be accepted as a surgical maxim. Sims believed that the properly applied silver suture was the basic factor in the cure of vesico-vaginal fistula. We recognize its value in infected wounds which must heal by granulation.

I consider that the primal factors to be accepted as fundamental in importance are the making and maintaining of an aseptic wound held in easy retention and rest by buried absorbable sutures.

180 Commonwealth Avenue.

ABSTRACT OF DISCUSSION

Dr. J. Wesley Bovee, Washington: I am glad to hear that Dr. Marcy advocates the separation of the vagina from its attachments for the closure of these fistulas. This subject was brought prominently before the professional world by

6. Marcy, Henry O.: Plastic Surgery of the Pelvic Structures, The Journal A. M. A., Nov. 30, 1907, p. 1831.

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George Gray Ward a few years since, and while he may not have been the first to do it—as I presume many of us had done it before that time—it certainly is the only efficient method for treatment of especially large fistulas. Some of these tax us, especially those in which the urethra is destroyed as well as the base of the bladder. We often see marked failures from other methods. In one case coming under my care two months ago, the patient had had during the past eight years eight operations for vesicovaginal fistula, all unsuccessful. One was a transperitoneal transvesical operation by a general surgeon. The woman had not passed her urine through the urethra in eight years. She had had a hysterectomy performed and the injury of the bladder was the direct cause of the fistula. In this case I did an operation by this method with perfect success. The suturing is done by this method plus the use of the Pesser catheter for from eight to twelve days. This insures practical success in all cases of this type.

Dr. Henry O. Marcy, Boston: This work has been elaborated by me originally, as I believe, and it involves a good many years of experimental study on the reconstruction of the pelvic structures. The last publication I made on this subject was before this Section in 1907. It is practically that which I have given you to-day. In all my operations since 1907 I have not had a single failure.

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COMMON ERRORS IN GALL-TRACT SURGERY

C. E. RUTH, M.D.
DES MOINES, IOWA

An operative technic which gives a low mortality may be far from perfection, especially when relief is not obtained by the patient from the trouble for which the operation was done, or when other calamities must be endured by the patient which are a direct result of the operation.

In no class of operative procedures for non-malignant conditions are secondary operations required in so large a percentage as in those done on the gall-tracts. In no class of abdominal work is the temptation greater for inefficient or incomplete work, and in none is complete work more difficult than that encountered in many of these cases. Stones in the common duct, at or near the lower end, are found and removed successfully by only a very few operators. The amateur aspirant to surgical honors and perquisites can safely drain a large readily accessible gall-bladder, and if perchance he find a stone, that is the end of the matter with him as covering all requirements and obligations.

I am reminded that once I opened the abdomen, after having done several thousand abdominal sections, and examined carefully for gall-stones and did not find any, but at post-mortem four weeks later seventeen stones were found in the gall-bladder and one in the ampulla of Vater.

At another time when doing an abdominal section for other causes I confirmed by direct palpation a previously made diagnosis of gall-stones, but six months

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later when the patient came to operation for removal of the gall-stones, I could not even find a gall-bladder, but encountered pancreatic calculi amounting to over a thousand grains, forming a complete cast of the entire pancreatic duct system. These I was able, with great difficulty, to remove successfully through incisions in the pancreas after opening through the gastro-hepatic fold of mesentery, which enabled me to reach the affected organ after displacing the stomach downward. I am convinced that no operation for relief of supposed pathology in the biliary tracts is completed without an examination of the pancreas.

The large number of secondary gall-tract operations is due to errors in diagnosis, failure to remove all calculi, allowing the drainage to close while infection is still active, and failure to remove the gall-bladder in all cases in which there is not a free communication or passage in both directions through the cystic duct, provided the common duct is freely patent.

Bile may often pass quite readily from the common duct into the gall-bladder, but returns with much difficulty or not at all by the ordinary contractions of the gall-bladder. In such cases permanent drainage or removal of the gall-bladder can alone afford permanent relief. The removal of the gall-bladder or its entire mucosa down close to the junction with the common duct is imperative to make relief permanent and obviate drainage annoyance.

In many cases of secondary operations following gall-bladder drainage I find the pyloric end of the stomach, first part of the duodenum, gall-bladder, liver and abdominal wall one continuous mass of adhesions. The result is that such a patient is never free from discomfort by pain, dragging, impaired stomach motility and often partial obstruction of the pylorus, which causes gastric dilatation with its accompanying entertainment. Unnecessary and rough handling of abdominal viscera during operation, unnecessary wiping of

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endothelial surfaces with gauze (especially dry gauze), extensive and unnecessary spreading of infection over clean territory and making no intelligent use of Nature's preventive material at hand are the principal causes of these deplorable and preventable complications. Relief of these patients from the operative complications requires much more skill and represents much more danger and difficulty than to deal properly with the original trouble.

In no case should the gall-bladder be attached directly to the abdominal parietes in drainage operations, because of the traction and dragging so liable subsequently to torture the patient. In all cases the drainage tube placed in the gall-bladder should be large and the margins of the gall-bladder should be inverted so that when the tube is removed the margins of the inverted gall-bladder opening at once collapse and promptly close the drainage (Figs. 3 and 4). However, should the bile show the presence of infection (by culture examination) a tube must at once be replaced and drainage maintained until the infection is under control.

The first or original tube placed in the gall-bladder must be secured by a catgut suture placed in the gall-bladder which will hold at least eight days (Fig. 4). The tube should lie free in the abdomen from where it leaves the gall-bladder to the point where it is to pass through the parietes, and at the latter point it should pass through a stab wound made on purpose for it, and should *never pass* (as is the almost universal custom) *through the main wound* (Fig. 5). The protruding end of the tube should then be connected to a drainage tube long enough to reach a safe distance from the patient (better attach it to the bed rail), where it enters a bottle containing 2 or 3 ounces of 10 per cent. alcohol-carbolic solution, into which the end of the drainage tube is passed so that the end of the tube is kept all the time below the surface of

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the liquid. This plan enables the main wound to be closed entirely and to remain dry, and in the vast majority of cases primary union can be secured, thus entirely eliminating other preventable complications, namely, suppuration of any part of the main wound, prolonged convalescence and a large percentage of hernias, for which there is *slight, if any, justification* (Fig. 6).

The use of the median incision for operating in all gall-tract cases will make it possible at the same time to deal with any other condition or complication in the abdomen through the same, or an extension of the same, incision, while it almost removes the temptation to use the main wound for drainage instead of the stab, say 2 inches to the right, which will give vastly better drainage, particularly with the patient lying on the right side. The time-honored incision through the rectus, straight or bayonet, is much more vascular than the median or near median incision, causing some degree of annoyance in operating, and when anything but a simple drainage of a readily accessible, distended gall-bladder is done, requires enlarging to such a degree that more or less sectioning must be done of the nerve supply to the abdominal wall and rectus with permanent sensory paralysis of a portion so that as one patient expressed it, "I am unable to tell whether I am feeling my own abdomen or some one else's except by sight," to say nothing of increased danger to hernia from imperfect motor and nutritive muscular innervation as well as liability to infection from drainage contact with the line of incision. Many gall-tract cases require appendenctomy, and in women often attention to the uterus or adnexa as well, in which case the median incision or an extension of it enables all to be done through the one incision with no necessity for any complication whatever arising from such extension and with no added operative difficulty. Any gall-tract operation can be done quite as well, and if complicated

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much better, through the median than through any other incision.

Removal of the gall-bladder is seldom difficult if done at the first operation under proper technic or as a secondary procedure, provided infection and trauma have not caused extensive and dense adhesions.

In my own work I prefer to remove the gall-bladder by first clamping the cystic duct between strong forceps close to its junction with the common duct, and then divide the duct between the forceps. The forceps placed on the cystic duct close to the common duct must be made to grasp the cystic artery also. The gall-bladder is then readily separated from the under surface of the liver and entirely removed almost without hemorrhage. In other cases in which adhesions are dense and it is difficult to find and follow the cystic duct, though the gall-bladder is accessible, I have found it easier and better to follow the gall-bladder and cystic duct downward from the fundus, splitting the bladder and duct all the way down. In this way I have found it easy to trace and the hemorrhage was slight. When the termination of the duct is found, it and the gall-bladder may be dealt with as above, or the mucosa of the cystic duct may be ligated close to the mouth of the duct, all the balance of the mucosa removed and the two outer coats closed over all, leaving a smooth peritoneal surface. This is quite as effective as removal and it as safely and permanently eliminates the gall-bladder as a subsequent annoyance and danger as the other plan.

A good-sized drainage tube should, however, be sutured in the bottom of the wound in contact with the point of greatest probability of bile leakage, and the patient should lie on the right side for the first forty-eight hours so that there will be free down-hill drainage through the tube to the outside of the body and no tendency to damming back or overflow through the general peritoneal cavity, but an open canal and no back pressure.

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An additional precaution is the placing of an angular or curved glass tubal connection in the drainage tube which passes through the abdominal wall and connecting the other end with a long tube which is passed into the drainage bottle; and by leaving 1 or 2 inches of the glass connection exposed, the presence or absence of drainage can be at once noted on inspection.

In obstruction of the common duct from inoperable carcinomatous conditions, it is wise to make an anastomosis between the fundus of the gall-bladder and the highest point available in the small intestine.

A small Murphy button properly placed makes an admirable anastomosis connection, though I think it wise to attach a string and piece of gauze to the intestinal side to exert traction on the button and prevent its sticking or perchance falling back into the gall-bladder.

When the gall-bladder is not available as above for switching the biliary current into the intestinal tract, and the common duct is largely lost by removal for malignancy, a soft rubber drainage tube may be inserted into the hepatic end of the common duct and secured by encircling catgut ligature and suture while the other end is inserted into the duodenum passing through the intestinal coats diagonally for ½ to ¾ inch. It should have a silk or linen thread attached to gauze in the intestine and fastened to the lower end of the tube. This will make light traction on the tube in all downward peristalsis, and will finally free the rubber, which will pass with the fecal current, but not before Nature's kindly offices have formed a mucous and endothelial-lined tube or new duct to convey bile into the intestine.

The function of the gall-bladder being to regulate the tension of the gall circulation and not at all for storage purposes readily accounts for the relative impunity with which it may be removed and the patient suffer no marked inconvenience in its loss.

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Avoidance of a return to the old habits of life which caused the original gall-tract infection will usually prevent a return of the conditions which necessitated the first operation, provided the operation be properly done or the patient's condition be such as to warrant a completed operation.

The time has long and forever gone when we operate on the gall-tract simply to remove stones. Recently I drained a gall-bladder for an infection which was only four days old and found that we were dealing with a most intensely vicious primary pure streptococcic infection. The progress of this case, however, was favorable until the tenth day when a pneumococcic infection caused complete consolidation of the entire right lung. The latter complication taxed the patient to the utmost and made it impossible to avoid infection of the main wound, which is a rare occurrence in our work, though a good recovery was made.

Three cases are of sufficient interest, I think, to justify reporting in some detail:

Case A.—Mrs. L., patient of Dr. Johnson, Alden, Iowa, was operated on about six weeks before she came into my hands, and drainage of the gall-bladder was done, but no stones were found. She was first seen by me Nov. 8, 1912, and operated on in Iowa Falls. She had obtained no relief from the previous operation.

Finding the pyloric end of the stomach and the first part of the duodenum firmly attached to the anterior abdominal wall, I released them and redrained the gall-bladder. Relief was prompt and continued so long as the drainage was maintained, but pain returned at once when the drainage of bile ceased.

She returned to me for operation, Feb. 3, 1913, at which time, dreading to remove the omental graft which I had placed to prevent the duodenum and stomach from uniting to the abdominal wall, and not enjoying the prospect of an enucleation of the gall-bladder because of the adhesions which I knew to be extensive and dense, I decided to drain permanently the gall-bladder into the nearest and most readily accessible part of the intestinal tract; this happened to be the hepatic flexure of the colon.

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The anastomosis was made with a small Murphy button with string and gauze in the intestine attached to the bottom. Recovery was without incident save that the button was never found, and she was absolutely free from pain and discomfort for five months, when the pain returned as before.

Examination showed that the cholecystenterostomy anastomosis had practically closed so that drainage of bile into the colon from the gall-bladder was no longer free, and the gall-bladder was found distended with bile which had become sufficiently stagnant within the cystic duct to begin the formation of calculi on mucous cholestin precipitate. The gall-bladder was accordingly removed after sectioning and permanently and carefully closing the former attachment to the colon. This plan offered the only apparent hope of permanent relief because the cystic duct patency permitted of tolerably free passage of bile into the gall-bladder but would not allow it to return readily by the same route.

Case B.—Woman, referred by Dr. Will G. Walker, Corydon, Iowa, was operated on in April, 1910, and had two gall-stones removed and some work done on the pelvic organs. March, 1911, she was operated on and another drainage of the gall-bladder was done. Neither operation gave any relief from pain or daily vomiting. She was first operated on by me Dec. 13, 1911, for a small inguinal hernia on the right side. Following this herniotomy she did not vomit for five weeks. Then vomiting returned and was as bad as before.

June 24, 1912, she returned for relief from pain and vomiting. Roentgenoscopy revealed dilatation and ptosis of the greater curvature of the stomach. Impaired motility of the stomach was believed to be due to adhesions. Opening the abdomen disclosed a mass of adhesions so dense and extensive that in the patient's enfeebled condition I lacked the courage to separate them and chose the easier operation, namely, a posterior gastrojejunostomy without loop, in the hope that better drainage of the stomach would control the pain and vomiting. Recovery was prompt and she rapidly gained in flesh and strength, but within a few weeks occasional vomiting and some pain returned, and within five months it was as bad as ever, though on a dry diet she would occasionally gain quite a little for a time in flesh and strength only to lose it again.

May, 1913, careful examination of stomach after Ewald and motor meals showed only evidence of impaired motility, presumably due to the old adhesions following her first two operations.

July 16, 1913, I separated the most extensive and dense adhesions, I have ever seen that were uniting stomach, duodenum, liver and anterior abdominal walls, and then over all the extensive area thus denuded I anchored omentum to pre-

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vent reformation of adhesions and limitations of the stomach and duodenal functions. Slight acute dilatation threatened for a couple of days, but yielded to the use of the stomach tube, after which recovery was uneventful and the patient gained about 30 pounds in weight in three or four months, but within eight months there was a return of the old symptoms and loss of all she had gained.

CASE C.—Mrs. G., referred by Dr. J. W. Garver, Peru, Iowa, was operated on in January, 1910, for cholelithiasis; in April, 1910, ovariotomy was done; in January, 1911, she was operated on for ventral hernia, and in September, 1911, for appendicitis. She came into my hands July 25, 1912, suffering from severe attacks of pain and vomiting. Pain was vaguely located in her upper abdomen. Her strength, however, was good and she was quite obese. She had dilatation of the stomach, and nearly all the omentum she possessed had been used up in adhesions resulting from previous operations. We had decided on gastro-jejunostomy as the safest and surest means of relief, but finding a gall-stone of considerable size, it was removed and drainage of the gall-bladder was done, after which I did my regular posterior gastro-jejunostomy without loop, *with rubber dam over the posterior edge of the anastomosis.* She has for nearly two years since operation been free from pain and vomiting, and has made considerable additions to her already abundant adipose.

These cases are presented as object lessons, in the belief that an analysis of the cases in which bad results were obtained or in which the patients were relieved only after four or five operations may help us in reaching the goal at a bound, or at most a second trial, in competent hands instead of repeatedly jeopardizing life in new operative attempts in which the surgeon's operative difficulties have been doubled or even quadrupled by previous bungling.

It is to be hoped that a better understanding of the value and use of the omentum may soon become more general among those who essay the art of surgery, that the stomach and intestines particularly may be less impaired in their subsequent functions after all abdominal work, but especially in the upper abdomen. All friction of a delicate endothelial surface in the abdomen by gauze of any kind must be avoided or reduced to the minimum. Especially must no dry gauze be allowed to *ever come in contact with any*

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endothelial surface in the abdomen unless it be for the deliberate purpose of destroying or injuring the same and causing adhesions as may be justifiable in attempts to secure *omental* vascular attachments to the abdominal walls in cases of ascites. The slightest contact of dry gauze with any of the endothelial lining of the abdominal cavity will destroy much of its surface.

Carelessness in failure to protect the intestines and omentum from skin contact, now that the use of iodin in skin preparation has become almost universal, is another cause of adhesion complication in otherwise clean and satisfactory operative procedures. It is not an uncommon sight in the operating room to see large masses of abdominal viscera rolled out of the abdomen on a skin surface, but recently painted with Churchill's tincture of iodin.

REPORT OF CASES IN GALL-TRACT SURGERY

CASE 1.—Mr. H. K., Manson, Iowa, aged 71, farmer.

Nov. 23, 1911. Cholecystotomy; calculus found with much pus and mucus, with extensive adhesions and points on the gall-bladder ready to slough. He was profoundly septic and had lost much flesh, having been seriously sick for four months. The liver was nodular with points of infarct. Death in thirty-six hours. Nature of infection not determined.

CASE 2.—Mrs. I. J. G., Peru, Iowa, aged 39, housewife. Referred by Dr. J. W. Carver, Peru, Iowa.

July 29, 1912. Cholecystotomy; removed one stone from gall-bladder. Gastrojejunostomy. Recovered. Remains well. Colon bacillus infection. Had had four previous abdominal sections within fifteen months for cholelithiasis, ovariotomy, appendicitis and ventral hernia.

CASE 3.—Mrs. William B., Dallas Center, Iowa, aged 60, housewife. Referred by Dr. J. H. Chiles, Dallas Center, Iowa.

Oct. 15, 1912. Cholecystotomy; entered the hospital in great agony which had lasted ten days and required frequent hypodermics of morphin. Operation immediately on entering hospital and 205 calculi removed, much pus and mucus present. Gangrenous gall-bladder mucosa was removed. Recovery without incident. Remains well. Nature of infection not determined.

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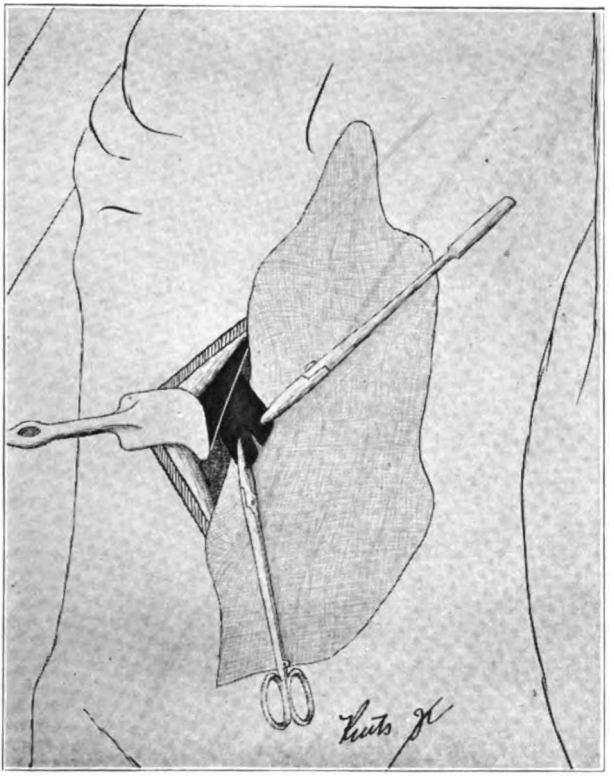

Fig. 1.—Author's technic. Method of incising gall-bladder, the fundus being grasped by flat forceps.

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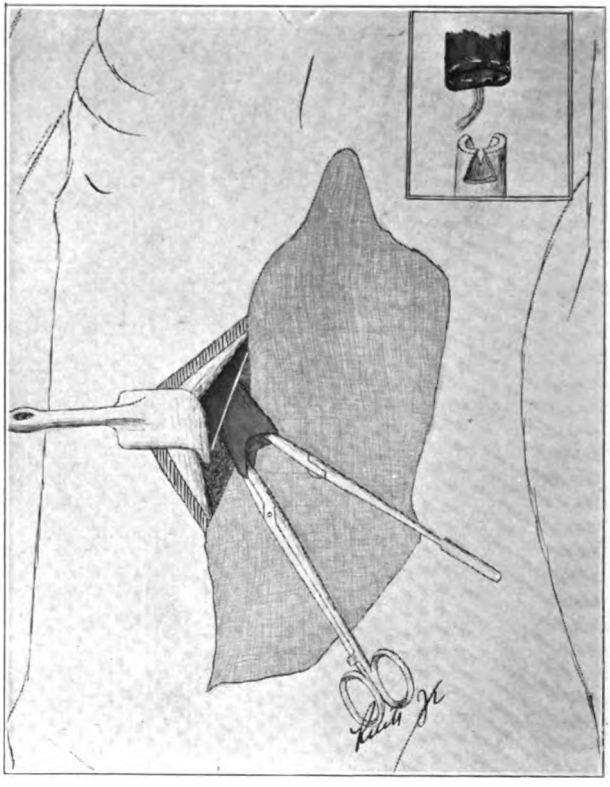

Fig. 2.—Opening in fundus spread, allowing ready access to the interior of the gall-bladder. Method of placing the first row of sutures, and the prepared drainage tube are depicted in the upper corner of the illustration.

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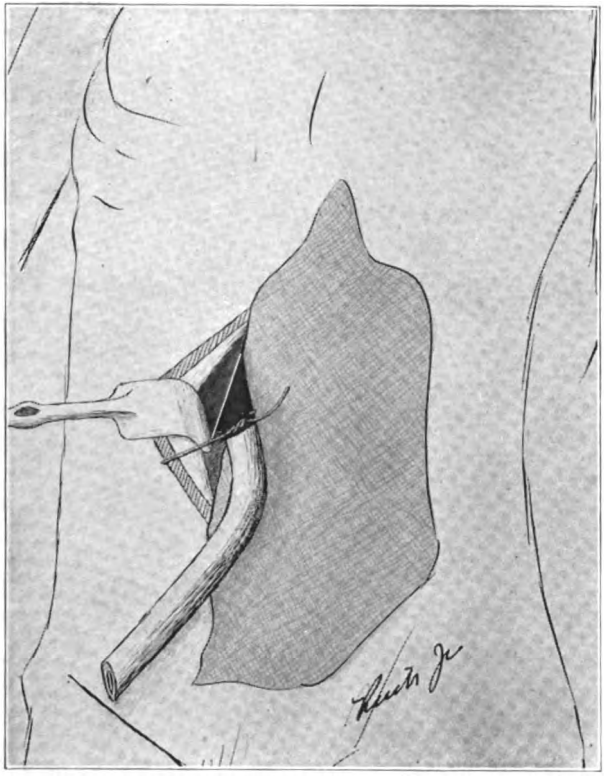

Fig. 3.—Drainage tube *in situ,* and held by the first row of sutures.

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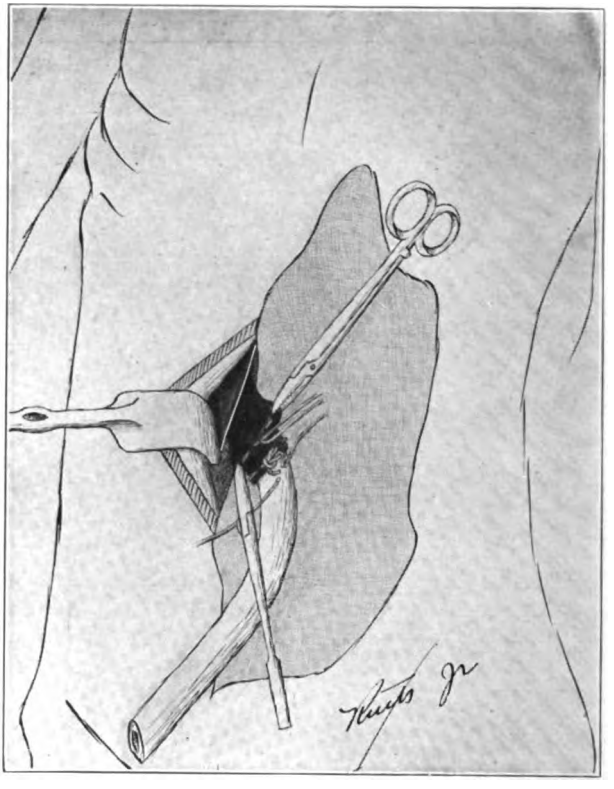

Fig. 4.—Second row of sutures in place and tube ready for inversion into the gall-bladder. Note the suture passing through the tube, insuring against dislodgment by undue traction or other accident. (The suture ends have not been tied and clipped.)

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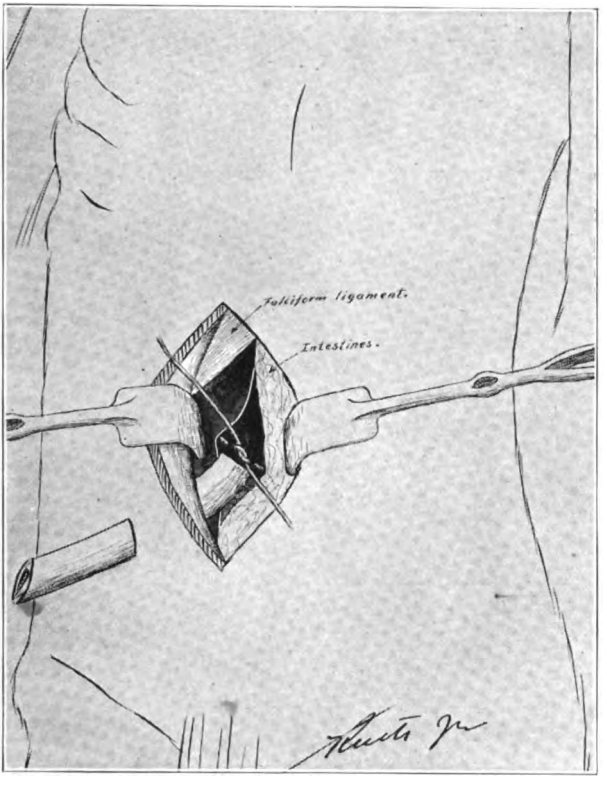

Fig. 5.—Showing position of parts after the tube has been inverted and the free end brought externally through a stab wound. Generally a stitch of silk-worm gut is placed through the skin edges and tube, again insuring against dislodgment of the tube by traction.

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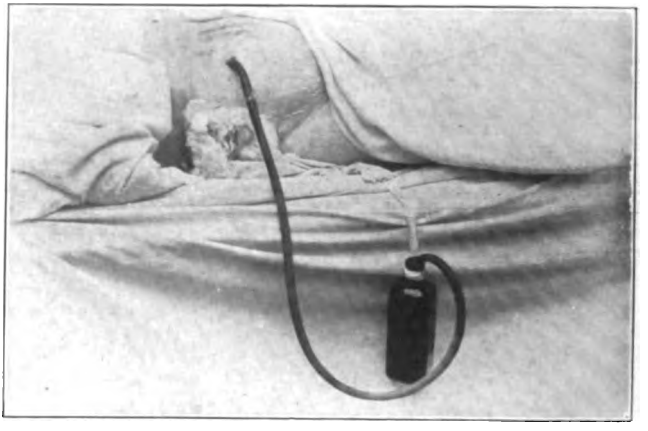

Fig. 6.—Showing arrangement of external drainage system. Skin about median wound remains slightly discolored from iodin stain. Note relation of stab wound to median incision, and the glass connection (sight drain) between drain proper and rubber tubing. Bottle, containing alcohol-phenol solution, should be lower than depicted, thus obviating all danger of kinking the tube at the neck of bottle.

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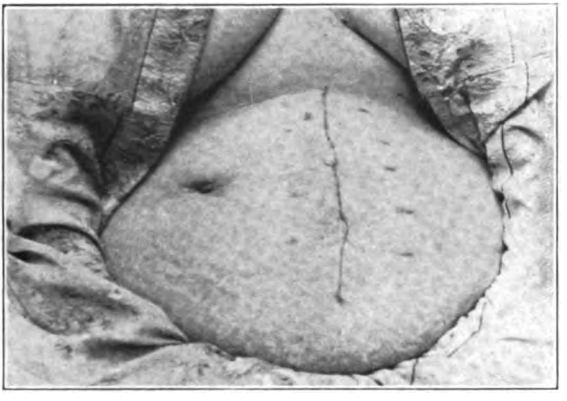

Fig. 7.—Same as Figure 6 (Case 21), showing abdomen after removal of drainage tube.

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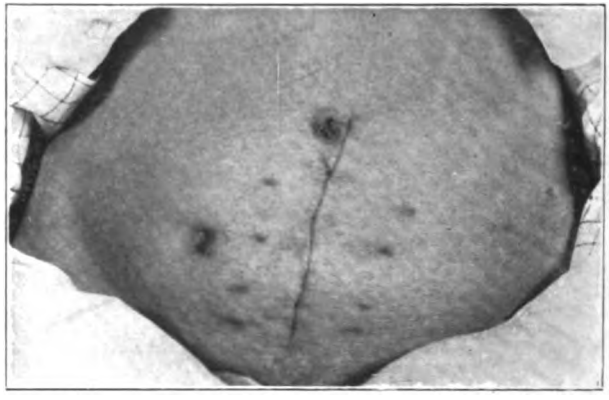

Fig. 8.—Showing applicability of method in case of general suppurative peritonitis complicated by acute dilatation of stomach, with enormous amount of fecal matter in the organ. Patient apparently moribund four days before abdominal section. Although median wound was bathed in purulent matter, union of the parts was obtained without any difficulty.

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SUMMARY OF OPERATIONS ON THE GALL-TRACT

Age	Case	Stones*	Operation	Complications	Infection	Remarks
1	71	+	Primary	Infarcts in liver profoundly septic	Not determined	Condition critical; pus; extensive adhesions; patient died†
2	39	+	Secondary	Gastrojejunostomy	Colon bacillus	Extensive adhesions
3	60	+	Primary	Profoundly septic	Not determined	Condition critical; pus
4	36	—	Secondary	.....	Mixed, colon bacillus, staphylococcus	Extensive adhesions‡
5	51	+	Primary	Phthisis very adv.	Colon bacillus	Condition critical
6	34	+	Primary	Appendectomy	Colon bacillus	.....
7	42	+	Primary	Appendectomy, trachylorrhaphy, perineorrhaphy and hemorrhoidectomy.	Mixed, colon bacillus, staphylococcus	Pus
8	34	—	Primary	Appendectomy and right oöphorectomy	Colon bacillus	.....
9	35	—	Primary	Appendectomy and ten days later pneumonia	Pure streptococcus	Condition critical
10	39	+	Primary	.....	Colon bacillus	Pus
11	50	—	Secondary P. O.	Ventral hernia and extensive adhesions	Not determined	Extensive adhesions§
12	48	+	Primary	Umbilical hernia and later perineorrhaphy and hemorrhoids	Colon bacillus	.....
13	36	+	Primary	.....	Colon bacillus	.....
14	64	+	Primary	Umbilical hernia	Colon bacillus	.....
15	53	—	Primary	Visceroptosis	Colon bacillus	.....
16	45	—	Primary	Appendectomy	Not determined	.....
17	45	+	Primary	Appendectomy	Staphylococcus	.....
18	58	—	Primary	Appendectomy, later phlebitis, septic	Mixed, colon bacillus, staphylococcus, streptococcus	Condition critical; extensive adhesions
19	54	+	Primary; secondary P. O.	Ventral hernia and ovariotomy	Colon bacillus	Condition critical; extensive adhesions‖
20	55	—	Primary; secondary P. O.	Hemorrhoidectomy	Not determined	.....
21	53	+	Primary	Appendectomy	Colon bacillus slow in clearing up	.....
22	27	—	Primary	Appendectomy	Pure staphylococcus	.....
23	33	+	Primary	Typhoid fever	Pure typhoid	Condition critical; pus

* In this column + indicates stones, and — no stones. † This was the only death in this series; the other patients recovered. ‡ Mrs. H. L. had one previous cholecystotomy operation for the same condition and required two subsequent operations before recovery was complete and permanent. The last consisted of cholecystectomy. § Mrs. L. E. S. had three previous abdominal sections which were accountable for the ventral hernia. Those three previous operations had been done by the same operator. Conditions unknown to the writer.

‖ The ventral herniotomy complication in this case (Mrs. M. C.) resulted from an abdominal section done by the writer two years previously when an ovariotomy was done for removal of a cyst containing 3 gallons of pus, and her temperature was 103 under profound sepsis.

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CASE 4.—Mrs. Hattie L., Alden, Iowa, aged 36, housewife. Referred by Dr. J. Johnson, Alden, Iowa.

Nov. 8, 1912. Cholecystotomy; no stones found. Same had been done six weeks before without relief, operator not named. Recovery uneventful, but relief lasted only during drainage.

Feb. 13, 1913. Anastomosis was made between the gall-bladder and the hepatic flexure of the colon with a Murphy button. Relief was immediate and recovery prompt. No bile in urine. Massive growth of colon bacillus and *Staphylococcus pyogenous albus* infection.

July 2, 1913. Pain having returned, the drainage into the colon was believed to have closed and another operation was advised. The gall-bladder was removed entirely. Recovery was prompt. Ten months have now passed and she remains well.

CASE 5.—Mrs. Adam R., Corydon, Iowa, aged 51, housewife. Referred by Dr. B. S. Walker, Corydon, Iowa.

Nov. 9, 1912. Cholecystotomy; very advanced tuberculosis (pulmonary). Removed large number of calculi. Recovery without incident, but she died soon after returning home from the phthisis. Colon bacillus infection.

CASE 6.—Mrs. Doyle McG., Rippe, Iowa, aged 34, housewife. Referred by Dr. A. I. Reed, Grand Junction, Iowa.

Feb. 10, 1913. Cholecystotomy; two large stones of mulberry type removed. Drainage. Appendectomy. Recovery without incident. Colon bacillus infection.

CASE 7.—Mrs. W. W. B., Corydon, Iowa, aged 42, housewife. Referred by Dr. J. N. McCoy, Corydon, Iowa.

Feb. 25, 1913. Cholecystotomy; removing many stones. Appendectomy. Much pus and mucus found in gall-bladder. Culture (two days' growth) colon bacillus and *Staphylococcus aureus* infection.

March 5, 1913. Curettage; double trachylorrhaphy; perineorrhaphy and hemorrhoidectomy. Recovery uneventful except development of cystitis which caused much annoyance. Ten months later well.

CASE 8.—Mrs. J. M. H., Lineville, Iowa, aged 34, housewife. Referred by Dr. J. S. Coontz, Garden Grove, Iowa.

March 8, 1913. Cholecystotomy; no stones found. Appendectomy and right oöphorectomy. Recovery without incident. Remains well. No bile in urine. Colon bacillus infection.

CASE 9.—Mr. E. F. A., Peru, Iowa, aged 35, merchant. Referred by Dr. J. W. Carver, Peru, Iowa.

March 14, 1913. Cholecystotomy. Ten days later the entire right lung became solidified, patient cyanotic, pure pneumococcus infection of the lung while the gall-bladder infection was a pure streptococcus, without stones. After development of the pneumonia, patient's vitality was taxed

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to the utmost for several days and in this case infection took place in the main wound resulting in a slight hernia, the only one we have had in which primary union did not occur, and the only one in which hernia has occurred. In this case we had a vicious infection of the gall-bladder, but union seemed to progress perfectly until the pneumonia set in with severe coughing and profound cyanosis required loosening of all constriction support of abdomen and lower chest.

March 12, 1914. Well. Slight ventral hernia. Left lung does most of the work.

CASE 10.—Mrs. J. H. G., Barnes City, Iowa, aged 39, housewife. Referred by Dr. Phil M. Day, Barnes City, Iowa.

April 11, 1913. Cholecystotomy; removed two stones, one of which was in the cystic duct. Much pus and mucus found. Recovery without incident. Colon bacillus infection. Ten months later well.

CASE 11.—Mrs. Luna E. S., Des Moines, Iowa, aged 50, housewife.

May 24, 1913. Leukocytosis of 12,200. Cholecystotomy; no stones. Drainage, thick tarry bile, pain and tenderness over fundus of gall-bladder with fever for three days. No growth on blood-serum. Enormous ventral hernia and extensive intestinal adhesions causing marked stenosis resulting from previous operations. Adhesions were all separated and the raw surfaces covered with omental grafts, a flap of aponeurosis was made from the right side to cover gap between the aponeurosis which could not otherwise be approximated. Her vitality was taxed severely for a couple of days, but otherwise recovery was without special incident.

May 9, 1914. She is perfectly well.

CASE 12.—Mrs. Mary A. E., Tipton, Iowa, aged 48, housewife. Referred by Dr. Thomas H. Flesher, Edmond, Okla.

June 27, 1913. Cholecystotomy; removing one stone. Umbilical herniotomy. Eight days later did perineorrhaphy and hemorrhoidectomy. Recovery without incident. Colon bacillus infection. Twenty-seven days after first operation discharged well.

Sept. 4, 1913. Reported well.

CASE 13.—Mrs. H. E. G., Ponce, P. R., aged 36, housewife.

Sept. 29, 1913. Cholecystotomy; twelve calculi removed. Drainage-tube removed the sixteenth day. Recovery without incident. Colon bacillus infection.

May 1, 1914. Well; reports better health than for many years.

CASE 14.—Mrs. Anthony W., Milo, Iowa, aged 64, housewife. Referred by Dr. Mack Hickman, Milo, Iowa.

Oct. 18, 1913. Cholecystotomy; gall-bladder found packed full of stones; drainage. Umbilical herniotomy. Colon

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bacillus infection. Discharged in three weeks. Eight months later reported well.

CASE 15.—J. E. R., Ottumwa, Iowa, aged 53, housewife.

Nov. 1, 1913. Cholecystotomy; no stones found; drainage. Shortened gastrohepatic fold of omentum and anchored omentum to support ptosed transverse colon. Recovery was slow from great previous feebleness. Colon bacillus infection. Five months later free from pain and better than for years.

CASE 16.—Mrs. C. L. M., Corydon, Iowa, aged 45, housewife. Referred by Dr. B. S. Walker, Corydon, Iowa.

Nov. 4, 1913. Cholecystotomy; no stones found. Appendectomy. Drainage. Unable to obtain growth but pain and fever were at once relieved and have not returned on last report five months later.

CASE 17.—Mrs. A. T. G., Corydon, Iowa, aged 45, housewife. Referred by Dr. B. S. Walker, Corydon, Iowa.

Nov. 4, 1913; Cholecystotomy; removed many large calculi; drainage. Appendectomy. Recovery without incident. *Staphylococcus albus* infection. Five months later well.

CASE 18.—Mr. J. D. M., Corydon, Iowa, aged 58, farmer. Referred by Dr. B. S. Walker, Corydon, Iowa.

Dec. 8, 1913. Cholecystotomy; no stones found; thick tarry bile. Colon bacillus infection, streptococci +, staphylococci +++, four days later displaced the cocci. Much inflammatory exudate between the gall-bladder, duodenum and stomach. Recovery rather stormy and complicated by phlebitis of the right leg. Five months later well.

CASE 19.—Mrs. M. C., Jefferson, Iowa, aged 54, housewife.

Dec. 12, 1913. Cholecystotomy; removed an enormous number of stones from a greatly distended, thickened, necrotic, densely and extensively adherent gall-bladder. Removed an ovarian cyst large as cocoanut. Ventral herniotomy. Her vitality was taxed heavily for a couple of days but recovery was in other respects devoid of incident. Colon bacillus infection. Six months later well.

CASE 20.—Miss Selena M., Hillsboro, Iowa, aged 55.

Jan. 6, 1914. Cholecystotomy; no stones found; drainage; thick tarry bile, but no growth obtained on blood-serum. Hemorrhoidectomy.

Feb. 24, 1914. Von Pirquet positive.

March 8, 1914. Pleural pneumonia. Lung did not clear entirely. Roentgen ray showed fluid in right pleura.

April 13, 1914. Aspiration without results.

April 27, 1914. Resected 2 inches of the right eighth rib and freed adhesions of right lung and drained; amount of fluid very small. Recovery from both operations was slow, but otherwise satisfactory.

May 20, 1914. Left hospital free from pain and fever and without cough.

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CASE 21.—Mrs. Charles R. Titonka, Iowa, aged 53, housewife.

March 23, 1914. Cholecystotomy; removing many stones; drainage. Appendectomy. Recovery without incident. Colon bacillus infection which was slow in clearing up requiring unusual drainage time. Two months later reported she was well.

CASE 22.—Mr. Ray E., Humeston, Iowa, aged 27, farmer. Referred by Dr. H. T. Smith, Humeston, Iowa

May 25, 1914. Cholecystotomy; no stones found; drainage. Appendectomy. Temperature 103 third day; required placing of drain in upper part of the main wound for a few days. Recovery otherwise not disturbed. Albumin heavy deposit, disappeared from urine in three days. Bile in urine. Bile culture shows pure *Staphylococcus albus* in twenty-four hours, while smear showed cocci at once.

CASE 23.—Mrs. T. L. L., Barnes City, Iowa, aged 33, housewife. Referred by Dr. Phil M. Day, Barnes City, Iowa.

June 1, 1914. Cholecystotomy; about ten calculi were removed, three of which were in the cystic duct, much pus and mucus removed. Thirty-one days before was taken with typhoid fever, had been free from fever for eight days when acute cholangeitis developed with renewal of fever May 30, 1914. Was seen by me June 1, 1914, and removed by auto and train 85 miles and operated on as soon as possible after entering the hospital. Patient ran a typical typhoid course after operation with subsultus picking at bed clothes, extreme restlessness without sleep. Temperature 101 to 103. Pulse 104 to 120. Culture from the pus taken from the gall-bladder was a pure typhoid bacillus. Two weeks after operation temperature normal, pulse 90 to 100. Rational. Taking nourishment well. Typhoid bacillus still present.

COMMENT ON OPERATIONS IN TWENTY-THREE CASES

The twenty-three cases in which operation was performed in the few months covered by the report present an average age of 46⅙ years, the oldest patient being 71 and the youngest 27 years of age.

Seven of the cases are noted as in a critical condition, by which I mean that they were emergency cases as truly as the average acute appendicitis.

One patient, however, was in the last stages of pulmonary tuberculosis and was operated on because of the terrible suffering from the cholelithiasis from which she begged operative relief. She recovered without incident from the operation, but died from

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tuberculosis soon after her return home. The operation gave her immediate and complete relief from pain.

There was only one fatality, and that in a man aged 71, who had had biliary obstruction for four months, was *in extremis* with profound sepsis and numerous infarcts in the liver, and the gall-bladder showed necrotic points.

Ether was the anesthetic used in all but the tuberculosis case, in which chloroform was given.

The operation time ranged from thirty minutes to one and three-quarter hours, according to the severity, difficulty and number of complications handled.

Gall-stones were found and removed in fourteen cases, no stones in nine. In Case 9, however, while we found no calculi we did find a pure streptococcus infection, and he had a leukocytosis of 62,200, with 90 per cent. of polymorphonuclears. Fifteen cases showed colon bacillus as the infecting organism, three of which had joined company with the staphylococcus, and in one case both sctreptococci and staphylococci were present.

Other operations and diseases are noted as complications and were present in twenty of the twenty-three cases.

Of these complications nine are appendectomies, two ventral herniotomies, two umbilical herniotomies, two perineorrhaphies, two ovariotomies for ovarian cysts, one trachylorrhaphy, three hemorrhoidectomies and one phlebitis. Three patients had profound sepsis, and in one of these gravely septic cases the gall-bladder mucosa, being necrotic, was removed. In only one case was a cholecystectomy done, and in one the mucosa of the gall-bladder was removed. All cases were drained until the discharge was nearly or quite sterile. In all but three cases the gall-bladder was inverted around the drain and all closed within one week after the drainage tubes were removed, and some did not drain longer than two days after removal of the tube.

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One case was complicated by visceroptosis and in that case the ptosed condition received operative attention.

One case developed consolidation of the entire right lung on the tenth day (pneumococcic infection), and in this case the infecting organism in the gall-bladder was a pure primary streptococcus.

In the series of twenty-three cases cholecystotomy was complicated by no less than twenty-nine operative or other conditions of greater or less importance.

If this small number of cases can be said to carry any important lessons for us it would seem to be that cholecystotomy without grave complications should be practically without mortality.

Cholecystotomy is no bar to other operative procedures if the patient is in good condition and the operations be properly done with sufficient dispatch, and whenever possible other important pathologic conditions should be eliminated as far as it is consistent with safety to the patient.

ABSTRACT OF DISCUSSION

Dr. Frederick Cotton, Boston: We all meet a lot of cases in which a secondary operation in gall-bladder surgery is necessary, and we all know the difficulty of preventing adhesions. Dr. Ruth spoke particularly of the median incision, which is not the usual incision made. I think we all agree that the old incisions are unnecessary; but as between the more usual incision at the side of the rectus abdominis and the median incision, there are certain grounds for debate. I have used the median incision for a good while in explorations and used the rectus incision for gall-bladder drainage. The danger of hernia is not common unless a duodenal leak occurs. I have seen only one case after digestion of the abdominal wall for weeks from escaping pancreatic juice. Hernia is not a particularly important factor in these upper abdominal cases if good closure is obtained.

Dr. Edward Martin, Philadelphia: Concerning but one or two points in Dr. Ruth's paper there may be a difference of opinion. Surgeons who operate on the liver and ducts may be compared to plumbers. A first-class plumber always leaves something to go back for. With the surgeon this something is not intentional but is incidental to an incomplete preparation and operative diagnosis. In a number of opera-

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tions for gall-stones they have not been found, or, indeed, anything else which could be bettered by surgical intervention. Under such circumstances if there be no evidence of back pressure, if the gall-bladder is normal and has not been treated brutally, what particular reason is there for drainage? The gall-bladder is easily, quickly and permanently closed, and the wound convalescence is as prompt as is that from any simple incision. Dr. Ruth advocates a median incision. In certain patients with lax abdominal walls the median incision will reach any point; but why we have adhesions, why we fail to find gall-stones, or to diagnose pancreatic conditions, is because we do not provide adequate access, without visceral and parietal trauma. The vertical cut if made in women with fat, full, tense abdomens gives poor access. If made to the inner side of the middle of the rectus muscle it divides no nerve trunks. If made to the outer side it divides the nerve-supply and is followed by atrophy of the rectus segment. Hernia develops and may become a distressing complication. Moreover, a satisfactory closure of the deeper part of the parietal wound is often difficult or impossible. The incision which gives best access, is least destructive and is most readily closed is first a vertical midline cut for primary exploration; then a transverse cutting of the rectus muscle five fingers' breadth above the umbilicus, a splitting of the external oblique, cutting of the internal oblique and a splitting of the transversalis upward and outward toward the costal border. The whole flap is turned up, when the liver and its ducts are entirely accessible for exploration or operation. Under this incision I have exposed and satisfactorily drained an abscess at the very top of the liver not bigger than a small apple. How many operators have been satisfied with closure of a vertical cut in one of the fat, full abdomens, the stitches tearing through the posterior rectal sheath on the slightest tension? The view of such a wound from within the abdomen gives a picture widely differing from that suggested by the final neat skin closure. With the vertical and transverse cut, the stitches hold because the direction of their pull is across that of the muscles and fascia, the wound comes together easily and the ultimate closure is good. Two fingers' breadth above the umbilicus is the usual position of the transverse tendinous lines of the rectus muscle. The suture is somewhat easier if the cut be carried through the line. This is, however, not necessary as mattress sutures readily approximate and hold in place the cut muscle surfaces.

Dr. Philander Harris, Paterson, N. J.: In operating on the gall-bladder for gall-stones I have employed one or other of the vertical or downward incisions. I have operated a few times by the central incision but not sufficiently often

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to become familiar with it. If I should adopt the central incision I question whether I could so easily deliver a portion of the liver as I can with the vertical incision. Whatever I might say against the central incision would be theoretic and not entitled to any consideration. I have employed nothing but stab-wound drainage in operating for gall-stones in more than eight years. I certainly feel that the best way to get undesirable secretion out of the body is to bring it through a stab-wound incision, getting as far to the right as has been indicated by Dr. Ruth. I do not drain through the incision, nor do I sew the gall-bladder to the peritoneum. The advantage, I believe, of stab-wound exit and efficient drainage established in that manner arises from the fact that it is on lower ground. Unless the patient is turned well to the right it is a decided advantage to have the drainage at the lower point of the incision and to the right of it. The operation might, perhaps, be improved by employing two large tubes instead of one. I have employed twin drainage with stab-wound exit for five years. With the double drainage two tubes come out of the stab-wound exit and from each of them there is a drainage pail. One tube may enter the gall-bladder; the other, any desired place. The gall-bladder is sewed with very fine catgut around the tube which enters it, and the catgut by which the fundus of the bladder adheres to this tube is carried out through the stab-wound by means of the forceps. In the first twenty-four hours blood comes out through the little triangular space. In two or three days the wick is withdrawn and the tubes may be left as long as desired. I believe that the operation of cholecystectomy is gaining ground while the operation of cholecystotomy is taking a less important place.

Dr. D. N. Eisendrath, Chicago: We are passing through the same stage with regard to common-duct surgery that we have passed through with the gall-bladder proper. There was a time when one could only make a diagnosis of gall-stones when the patient had jaundice. That we cannot have common-duct stone without jaundice is a belief that had better be dropped. I find that the secondary cases have been those in which the gall-bladder has been taken out and in which the operator did not have the courage to take out the common duct. It is time for us to decide that when we operate for gall-bladder disease we have to consider also the condition of the common, hepatic and cystic ducts. If I find gall-stones in the gall-bladder it is the last part of my operation. As Dr. Martin said, we cannot get as good exposure of the common duct through the median as through the lateral incision. Kehr, a year ago, reported 54 cases in which he had examined the common duct and in 32 palpation was negative and yet stones were found. In over 50 per cent. of

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my cases when palpation was negative, by opening the common duct I have found stones. My technic is to leave the gall-bladder alone at the early part of the operation, take a couple of traction sutures and open the common duct between them, explore toward the ampulla and up into the hepatic duct. A considerable number of the so-called secondary operations are due to overlooking common-duct stones. Another element of failure is leaving a gall-bladder in, which ought to have been taken out at the first operation. Taking the gall-bladder out in the secondary operation is most difficult. Everything is so adherent that you cannot get a line of cleavage. This can be avoided if the gall-bladder is taken out primarily. When the common duct is enlarged to the size of the index finger, or its walls are thickened or there are many small stones in the gall-bladder the common duct must be explored. If there is marked pancreatitis, drainage of the common duct is also of much benefit. It has been shown experimentally that at the end of three weeks the bladder, no matter how badly infected, is sterile.

Dr. J. H. Carstens, Detroit: It seems that all these cases depend on circumstances. We can remove the gall-stones, sew up the gall-bladder and drop it back. If there is an infected gall-bladder this cannot be done. It can be done only with the mulberry variety of gall-stones; this I often do. In clean cases I make the incision transversely in the direction of the fibers of the external oblique muscle, separating them and pulling them apart. Then I separate the fibers of the rectus in the opposite direction without cutting them and pull them apart. I separate the transversalis fibers and take hold of the gall-bladder, opening it and remove the stone or stones, and carefully close it, bringing the edges together and amplifying it with a row of Lembert sutures. I then drop the gall-bladder and close the opening in three layers. The incision is always very small. I thus have not cut any nerves and there is no danger of hernia. I make the same incision in ordinary cases, when I want to drain but do not attach the gall-bladder to the incision. In some cases there are extensive adhesions but they have produced no symptoms. I generally can feel the ducts, and if I find no trouble I let the adhesions alone, because if they are broken they may produce new adhesions that will cause serious symptoms. I separate only enough adhesions to get to the top of the gall-bladder, which I open, scoop and float out the gall-stones, and insert a drainage-tube. If I have an infected gall-bladder I do not operate until the acute inflammation has subsided, if possible. Then I make as small an incision as possible, pull up the gall-bladder and stitch it all around to the peritoneum without opening it. I have thus the peritoneum clean and closed and can open the gall-bladder and wash out the gall-stones without danger of

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infection. Sometimes I also take out the gall-bladder if it is gangrenous, or remove only the lining membrane. As a rule, before I touch the gall-bladder I explore the ducts. If they are pervious and contain no stones I let them alone; if they are large I split them up, but I would not split up every one when there is nothing the matter with it. In some of these cases we also have a loose liver coming down and causing great distress. In such cases I generally scrape the surface of the liver and the anterior peritoneum behind the ribs, shove the liver into place as nearly as possible and then stitch the gall-bladder to the incision, which I make quite high, and it helps materially, I think, to keep the liver in place, although the latter may become sufficiently adherent to relieve the symptoms without the attachment of the gall-bladder.

Dr. John A. McGlinn, Philadelphia: Gall-stone disease is essentially a surgical disease and not medical; and, if diagnosed, the stones should be removed. Medical men claim that gall-stones may be innocuous for a number of years. Two years ago I studied the reports of some 9,000 post-mortems. Of these there were 565 gall-stone cases with not one uncomplicated case. In some there were adhesions, in others cancer, changes in the liver or pancreas. That gall-stones may remain innocuous was demonstrated in that in twenty-three of the 565 cases the diagnosis was gall-stones. The reason we have secondary operations is because we do not realize the full pathology of gall-stones. In these 565 cases there were very few in which the lesions were limited to the gall-bladder alone. In practically all there were gall-stones in the common or cystic duct or changes had taken place in the pancreas or duodenum or there were dense adhesions in the upper part of the abdomen. If I found gall-stones in the gall-bladder I would remove them and drain it. The disease is not limited to the gall-bladder but involves the whole upper right quadrant of the abdomen. With full exposure there is less occasion for a secondary operation with the pain and discomfort following.

Dr. F. D. Gray, Jersey City, N. J.: The question of double drainage mentioned by Dr. Harris should, to my mind, only arise under exceptional circumstances. It might be considered when the field of operation has been soiled or when there is uncontrollable oozing of blood. Again there may be a doubt in one's mind whether the sutures will hold in unusually softened tissues with a resultant leakage. If there is any necessity for drainage, except that of the gall-bladder, it appears to me that a drainage tube will, in that location not be sufficient, on account of the tendency of septic fluids to gravitate into the lower abdomen. The most effective thing under these circumstances is to introduce a

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strip or two of iodoform gauze beneath the gall-bladder (or its stump in cases of cholecystectomy), below which is inserted a layer of dental dam, to prevent adhesions, the whole of which constitutes a coffer dam, as it were, to intercept and carry all drainage fluids to the surface. In my opinion this is more effective than a second tube can be and I have had good results with the method.

Dr. Channing W. Barrett, Chicago: The necessity for the median incision can be done away with by a double incision instead of a compromise one to reach two extreme ends of the abdomen. The compromise incision never reaches either end very well. If the gall-bladder is to be operated on, a 3-inch incision will attend to that. This can be made without injury to the abdominal wall and nerves.

Dr. C. E. Ruth, Des Moines, Iowa: I use the stab-wound drainage because properly used it will never produce hernia. No drainage, however, can be continued through any wound without some infection about it, and for that reason there is a liability that if we use the main wound for drainage we will add to or cause infection that could be avoided. So far as hernia is concerned, possibly it is not common in the East, but it has been with me a source of great trouble, not in my own cases, however. The secondary cases coming to me with hernia are not a few. In determining the time of drainage we have, in practically all our cases for the last year and a half, made repeated cultures before we allowed closure of the wound. We never allowed the wound to close until the primary infection had become decidedly diminished in virulence. The staphylococcus from the skin we try to avoid by taking our cultures far down in the gall-bladder. With reference to stones being the cause, as mentioned by Dr. Martin, for this operation, I believe they are the primary cause of infection. I never object to the straight median incision and I increase the size if necessary to get the space for rolling the liver out. I do object particularly to the old longitudinal incision that starts under the rectus and which, if prolonged, does cause destruction of the nerve-supply to a portion of the abdomen. If one prefers to use two incisions I have no objection, but I prefer one. I have never found it necessary to use more than one, or to curve the incision to the right. I can conceive of the possibility for it, but so far have not found it necessary. There is no question that the use of two tubes when the peritoneum is soiled, is good practice. I have abandoned stitching the gall-bladder to the peritoneum because of the traction. I like the use of the round ligament for the suspension of the gall-bladder.

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LIST OF FELLOWS OF THE AMERICAN MEDICAL ASSOCIATION REGISTERING IN THE SECTION ON OBSTETRICS

The following is a list of Fellows of the American Medical Association who, at one or more of the last five sessions, have registered in the Section on Obstetrics, Gynecology and Abdominal Surgery. The figure following the name indicates the year in which the member registered (0 indicating 1910, 1, 1911, etc.). Any errors which may have occurred should be brought to the attention of the secretary of the Section.

Abbott, Chas. N., Chippewa Falls, Wis. 3.
Abbott, Geo. E., 161 N. Los Robles Ave., Pasadena, Cal. 1.
Abrams, Edw. T., Dollar Bay, Mich. 9, 0, 3, 4.
Adair, Fred L., 820 Donaldson Bldg., Minneapolis, Minn. 3.
Adams, C. T., 5701 Girard Ave., Philadelphia. 9, 2.
Ahrens, A. H., 920 Rice St., St. Paul, Minn. 3.
Alderson, J. C., 311 Jefferson St., Wausau, Wis. 3.
Alexander, A. F., 379 Union Ave., Paterson, N. J. 7, 9, 1, 2.
Alexander, Robt. J., Amicable Bldg., Waco, Tex. 4.
Allen, Frederick B., 147 N. Main St., North Wales, Pa. 2.
Altman, J. T., cor. Church and Vine Sts., Nashville, Tenn. 4, 5, 6, 0, 2.
Altman, Maurice, 404 Goldsmith Bldg., Milwaukee, Wis. 0.
Anderson, Winslow, 1065 Sutter St., San Francisco. 0, 1.
Andrews, Leila E., 404 Colcord Bldg., Oklahoma City, Okla. 4.
Angle, Geo. K., Silver City, N. Mex. 0.
Anspach, Brooke M., 119 S. 20th St., Philadelphia. 9, 2, 3, 4.
Apjohn, Henri, Box 94, Yuma, Ariz. 1.
Appel, Theo. B., 305 N. Duke St., Lancaster, Pa. 3.
Applegate, J. C., 3540 N. Broad St., Philadelphia. 2, 4.
Arnold, J. O., 2503 N. 18th St., Philadelphia. 7, 9, 2, 4.
Arnett, Jas. H., 2540 N. 11th St., Philadelphia. 4.
Arthur, Mattie L., 407 Paxton Blk., Omaha, Neb. 1.
Ashton, Wm. Easterly, 2011 Walnut St., Philadelphia. 2, 4.
Ashum, David W., Eau Claire, Wis. 3.
Auge, Emily G. Whitten-, 2734 Wharton St., Philadelphia. 4.
Bachmann, Geo. W., 320 Central Park, Rochester, N. Y. 4.
Bacon, Charles E., 730 Kingsley Drive, Los Angeles, Cal. 1.
Bacon, Charles S., 2156 Sedgwick St., Chicago. 4, 5, 6, 7, 8, 9, 0, 2, 3, 4.
Bacon, Knox, 1118 Summit Ave., St. Paul, Minn. 3.
Baer, Jos. L., 4955 Forrestville Ave., Chicago. 4.
Bailey, Harold C., 269 Lexington Ave., New York City. 2.
Bainbridge, Wm. S., 34 Gramercy Park, New York City. 4.
Baker, Geo. W., 410, 25th St., Ogden, Utah. 0.
Baker, Marshall, 20 Grove Ave., Webster Groves, Mo. 0.
Baldy, John M., 2219 DeLancy St., Philadelphia. 0, 2, 4.
Bandler, Samuel W., 134 W. 87th St., New York City. 7, 0.
Barbour, E. E., 427 Jefferson Bldg., Peoria, Ill. 8, 0.
Barnard, E. P., 119 S. 19th St., Philadelphia. 4.
Barnes, C. S., 35 S. 19th St., Philadelphia. 9, 2, 4.
Barnes, S. S. P., 311 E. Main St., Massillon, Ohio. 9, 1.
Barney, Delbert, 55 N. Washington St., Wilkes-Barre, Pa. 2.
Barney, N. Eugenia, Sterling, Colo. 1.
Barnhart, Wm., 318 N. Mathews St., Los Angeles, Cal. 1.
Barrett, C. W., 446 St. James Pl., Chicago. 4, 6, 9, 0, 3, 4.
Barrett, Fred'k, Gilbert, Minn. 3.
Bartlett, C. W., 70 North St., Bennington, Vt. 4.
Bassett, C. W., 505 N. 7th St., St. Louis. 0.
Bastian, Jos. W., 915 Washington St., Wilmington, Del. 4.
Battey, H. I., 604 Atlanta Nat. Bnk. Bldg., Atlanta, Ga. 3.
Baxter, Stephen H., 2000 Hennepin Ave., Minneapolis, Minn. 3.

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Beach, Edw. W., 5401 Spruce St., Philadelphia. 4.
Beattie, T. J., 1203 Waldheim Bldg., Kansas City, Mo. 5, 6, 0.
Bell, J. F., 2 Grove Ave., Elgin, Ill. 0.
Bell, J. N., 506 Washington Arcade, Detroit. 0, 3, 4.
Benjamin, A. E., 2222 Blaisdell Ave., Minneapolis, Minn. 6, 9, 0, 1, 2, 3.
Benson, Marion T., 501 Century Bldg., Atlanta, Ga. 4.
Bentele, Elizabeth, Mt. Clemens, Mich. 0.
Berlin, Lewis, 464 Freemason St., Norfolk, Va. 4.
Bernardy, Henry L., 321 S. 11th St., Philadelphia. 2.
Bill, Arthur H., 310 The Osborn Bldg., Cleveland. 4.
Bland, P. B., 1621 Spruce St., Philadelphia. 9, 1, 2, 4.
Blazejewski, S. W., 103 N. Jordan St., Shenandoah, Pa. 4.
Block, Frank Benton, 1503 Girard Ave., Philadelphia. 4.
Blocklinger, A. H., 146, 5th St., Dubuque, Iowa. 0.
Boice, J. Morton, 4020 Spruce St., Philadelphia. 4.
Boldt, Herman J., 39 E. 61st St., New York City. 6, 7, 8, 9, 0, 2, 4.
Bonifield, C. L., 1763 E. McMillan Ave., Avondale, Cincinnati. 4, 5, 6, 7, 8, 2, 4.
Boswell, Charles J., Mounds, Ill., 6, 0.
Bourland, J. W., 3823 Rawlins St., Dallas, Tex. 3.
Bowen, W. Sinclair, 1339 Connecticut Ave., Washington, D. C. 4.
Bovée, J. Wesley, The Rochambeau, Washington, D. C. 4, 6, 7, 9, 2, 4.
Bowers, L. G., 141 W. 4th St., Dayton, Ohio. 8, 9, 1.
Bowman, John W., Lemoyne, Pa. 2.
Boxer, Henry, 1008 Elm St., Birmingham, Ala. 3.
Boyd, D. H., 2345 Perrysville St., Pittsburgh. 0, 4.
Boyd, G. M., 1909 Spruce St., Philadelphia. 4, 6, 9, 2, 4.
Boys, C. E., 1404 Portage St., Kalamazoo, Mich. 8, 3.
Boysen, Peter, Pelican Rapids, Minn. 3.
Bozenhardt, William F., 50 Forest Ave., Brooklyn. 2.
Braasch, W. F., Rochester, Minn. 1.
Brack, Chas. Emil, 500 E. 20th St., Baltimore. 2.
Branson, L. H., 103½ S. Clinton St., Iowa City, Ia. 5, 6, 7, 8, 1, 3, 4.
Branton, B. J., Willmar, Minn. 3.
Braunwarth, Emma L., 112 E. 2d St., Muscatine, Iowa. 6, 1.
Brecker, N. Francis, 2347 St. Albans St., Philadelphia. 4.
Bresee, Paul, 909 Los Angeles Invest. Bldg., 8th and Broadway, Los Angeles, Cal. 1.
Brickell, J. B., Americus, Kan. 1.
Brickner, Samuel M., 66 Lake Flower Ave., New York City. 2.
Briggs, H. W., 1026 Jackson St., Wilmington, Del. 6, 7, 9, 2.
Brinkman, J. E., 528 Commercial St., Waterloo, Iowa. 3.
Broad, George B., 606 E. Genesee St., Syracuse. 2.
Broadrup, G. L., 203 Virginia Ave., Cumberland, Md. 6, 9, 1, 2, 4.
Broun, LeRoy, 148 W. 77th St., New York City. 2, 4.
Brown, Adelaide, 45, 16th Ave., San Francisco. 3.
Brown, Columbus, Herrin, Ill. 0.
Brown, Ellen E., 714 Madison St., Chester, Pa. 4.
Brown, E. L., 608 Livingston Bldg., Bloomington, Ill. 4.
Brown, Ewing, 3405 Farnam St., Omaha, Neb. 3.
Brown, Wm. M., 1776 East Ave., Rochester, N. Y. 2.
Bryson, Chas. W., Delta Bldg., 426 S. Spring St., Los Angeles, Cal. 1.
Bullard, R. T., 71241 W. 8th St., Los Angeles, Cal. 5, 9, 0, 1, 2.
Bunting, P. D., 1060 E. Jersey St., Elizabeth, N. J. 9, 4.
Burch, L. E., 150 N. Spruce St., Nashville, Tenn. 6, 9, 4.
Burkhardt, C. F., Effingham, Ill. 0.
Burkhard, E. D., Del Agua, Colo. 3.
Burckhardt, Louis, 620 Hume-Mansur Bldg., Indianapolis, Ind. 3.
Burnam, Curtis F., 1418 Eutaw Pl., Baltimore. 2, 4.
Burns, Howard, Carrollton, Ill. 0.
Burns, Robt. M., 679 E 3d St., St. Paul, Minn. 3.
Burns, T. M., 640 Metropolitan Bldg., Denver. 0, 1, 2, 4.
Bushby, A. L., Corwith, Iowa. 3.
Butz, R. E., 160 E. Market St., York, Pa. 4, 6, 1, 2.
Byford, H. T., 1411 E. 51st St., Chicago. 8, 0.
Byrum, J. M., Box 222, Shawnee, Okla. 0.

Cadwallader, I. H., 919 Taylor Ave., St. Louis. 4, 8, 0.
Cain, C. L., Elmwood, Wis. 3.
Campbell, H. C., Whitehall, Ill. 8, 0.
Campbell, Harry M., 1206 Market St., Parkersburg, W. Va. 1.
Cape, L. W., 7396 Hazel Ave., Maplewood, St. Louis. 0.
Carley, H. D., 3332 Bell Ave., St. Louis. 0.
Carpenter, Frank B., 3966 Washington St., San Francisco. 1.
Carpenter, Julia W., 2636 Park Ave., Cincinnati. 2.
Carstens, J. H., 620 Woodward Ave., Detroit. 4, 5, 6, 7, 9, 0, 2, 3, 4.
Cates, A. B., 2824 Park Ave., Minneapolis, Minn. 3.
Chace, Archibald E., 76 Broadway, Tarrytown, N. Y. 4.
Chadbourn, A. G., Heron Lake, Minn. 3.
Chalfant, Sidney A., 5713 Rippey St., Pittsburgh. 0, 2.
Chandler, S., 225 S. 20th St., Philadelphia. 4, 6, 7, 9, 2, 4.
Chapman, W. E., Litchfield, Minn. 3.
Chard, Marie L., 616 Madison Ave., New York City. 9, 2, 3, 4.

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Chatterton, A. S., Peterson, Iowa. 3.
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Clark, J. A., 2026 W. 21st St., Chicago. 1.
Clark, John G., 2017 Walnut St., Philadelphia. 4, 6, 9, 0, 2, 4.
Clark, M. T., Temple, Okla. 0.
Clark, S. M. D., 1619 Arabella St., New Orleans, La. 6, 9, 1, 2, 3.
Clarke, Wm. T., 1777 W. Jefferson St., Los Angeles, Cal. 1.
Clarkson, W. H., Manhattan, Kan. 1.
Clawson, Marcus L., 420 Park Ave., Plainfield, N. J. 2.
Clegg, J. T., Siloam Springs, Ark. 0, 1.
Coates, Benj. O., 221 North Euclid Ave., Pasadena, Cal. 1.
Cobb, W. F., Lyle, Minn. 3.
Coe, Henry C., 8 W. 76th St., New York City. 2.
Coffey, Titian, 926 Marsh-Strong Bldg., Los Angeles, Cal. 1.
Cogill, Lida Stewart, 1831 Chestnut St., Philadelphia. 2, 4.
Cole, C. Grenes, 1109 Maison Blanche Bldg., New Orleans. 4.
Coles, Stricker, 2103 Walnut St., Philadelphia. 4, 9, 2, 4.
Colgan, Jas. F. E., 1022 N. 5th St., Philadelphia. 4.
Collins, J. L., Sheffield, Iowa. 3.
Comfort, Clifford V. C., 512 Mercantile Bldg., Rochester, N. Y. 2.
Commiskey, Leo J. J., 189, 6th Ave., Brooklyn. 2.
Conaway, W. P., 1723 Pacific Ave., Atlantic City, N. J. 4, 9, 2, 3, 4.
Congdon, Charles E., 859 Humboldt St., Buffalo. 2.
Conner, A. L., 7056 Main St., Philadelphia. 7, 2.
Conrad, S. Alvin, Leetonia, Ohio. 4.
Conrad, Thos. K., Chevy Chase, Md. 4.
Conway, H. P., Spring Valley, Wis. 3.
Cook, Chas. P., 911 E. Spring St., New Albany, Ind. 0.
Coon, W. F., Caney, Kan. 3.
Cooper, St. Cloud, Fort Smith, Ark. 0.
Cootes, Thos. G., 1413 Lombard St., Philadelphia. 4.
Copeland, M. A., 202 Farley Bldg., Birmingham, Ala. 0.
Cory, W. M., Waterville, Minn. 3.
Cousins, Wm. L., 231 Woodfords St., Portland, Me. 4.
Coventry, W. A., 721 E. 3d St. Duluth, Minn. 4.
Crowley, Daniel F., 208 Flynn Bldg., Des Moines, Iowa. 3.
Cosgrave, Millicent, 350 Post St., San Francisco. 1.
Cowles, J. E., 524 Mer. Nat. Bank Bldg., Los Angeles, Cal. 1.
Craig, N. S., Jennings, La. 8, 3.
Crain, B. F., Carterville, Ill. 0.
Creamer, Michael S., 501 Homer Laughlin Blk., Los Angeles, Cal. 1.
Crossen, H. S., 5423 Bartmer Ave., St. Louis. 9, 0.
Crotty, Nora, 75 The Groton, Cincinnati. 2.
Culbertson, Carey, 3547 Adams St., Chicago. 8, 0.
Culbertson, Emma B., 33 Newbury St., Boston. 3.
Cullen, T. S., 3 W. Preston St., Baltimore. 4, 6, 7, 8, 3, 4.
Curtis, A. N., 4205 Virginia Ave., St. Louis. 0.

Daniels, C. D., 2267 N. 18th St., Philadelphia. 4.
Dannreuther, Walter T., 2030 Broadway, New York City. 2, 4.
Darling, Chas. B., 50 Townsend St., Boston. 6, 1.
Darnall, W. E., 1704 Pacific Ave., Atlantic City, N. J. 6, 9, 2, 4.
Davenport, James Henry, 210 Benefit St., Providence. 2.
Davidson, H. A., 418 Atherton Bldg., Louisville, Ky. 4.
Davies, Wm. Rowland, 221 S. Main Ave., Scranton, Pa. 3, 4.
Davis, Albert B., 511 Cooper St., Camden, N. J. 2, 4.
Davis, Asa Barnes, 42 E. 35th St., New York City. 4.
Davis, E. C., 25 E. Linden St., Atlanta, Ga. 0, 2, 3, 4.
Davis, Edward P., 250 S. 21st St., Philadelphia. 6, 7, 2, 4.
Davis, Ella M., 188 Chestnut St., Holyoke, Mass. 9, 4.
Davis, I. C., 19 Cumberland St., Rochester, N. Y. 4, 9, 2.
Davis, John D. S., 2031 G Ave., Birmingham, Ala. 6, 7, 0, 2.
Davis, W. J., 229 Barney St., Wilkes-Barre, Pa. 2.
Deaver, John B., 1634 Walnut St., Philadelphia. 4.
Deichmann, O. H., 411 E. Capitol Ave., Springfield, Ill. 0.
DeLee, J. B., 5028 Ellis Ave., Chicago. 8, 2, 3, 4.
Denney, Jos. C., Clyde Park, Mont. 3.
Dennis, Mary E., 1217 Trenton St., Los Angeles, Cal. 1.
DeVenney, J. C., 1115 N. 2d St., Harrisburg, Pa. 2.
Dickinson, Robert L., 168 Clinton St., Brooklyn. 2, 4.
Diez, M. Luise, 5733 Spruce St., Philadelphia. 2.
Dilliard, Benjamin F., East Bangor, Pa. 2.
Disen, Chas. F., 2600 E. 22d St., Minneapolis, Minn. 3.
Doane, Philip S., 1427 N. State St., Chicago. 0.
Dodds, Robt., 3946 Cottage Grove Ave., Chicago. 4.
Dodge, Roy A., 446 Brandeis Bldg., Omaha, Neb. 3.
Doederlein, T. J., 5713 Kenmore Ave., Chicago. 0.
Donaldson, Harry J., 106 E. 4th St., Williamsport, Pa. 4.
Donoghue, Francis D., 864 Beacon St., Boston. 5, 6, 7, 9, 2.
Dorsett, E. L., 410 Woll Bldg., St. Louis. 8, 0.

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Downs, R. N., Sr., 6008 Greene St., Philadelphia. 4.
Dowman, Chas. E., Jr., Empire Life Bldg., Birmingham, Ala. 4.
Doyle, O. B., Box 913, Fresno, Cal. 1.
Drechler, Louis, 2701 Blair Ave., St. Louis. 0.
Du Bose, F. G., Selma, Ala. 4.
Dugdale, R. B., 127 S. Lafayette St., South Bend, Ind. 1.
Duncan, H. A., 2721 W. Lehigh Ave., Philadelphia. 9, 2.
Dunlap, Elbert, Wilson Bldg., Dallas, Tex. 0.
Dunn, J. E., Stratford, S. Dak. 3.
Dunsmoor, John M., 218 Stimson Bldg., Los Angeles, Cal. 1.
Dunsmoor, Nannie C., 330 Laughlin Bldg., Los Angeles, Cal. 1.
Durrie, Anna B., % Colo. Sanit., Boulder, Colo. 1.
Dwire, Francis B., Gardena, Cal. 1.

Eastman, T. B., 308 Pennway Bldg., Indianapolis. 5, 8, 3.
Eaton, Alvin R., Jr., 1157 E. Jersey St., Elizabeth, N. J. 2.
Echols, C. M., 800 Majestic Bldg., Milwaukee, Wis. 2, 3, 4.
Edwards, Thos. C., 224½ Main St., Salinas, Cal. 1.
Ehrenfest, Hugo, 4333 McPherson Ave., St. Louis. 0.
Eidmann, Walter P., 3160 Morganford Rd., St. Louis. 0.
Elkin, W. S., 27 Luckie St., Atlanta, Ga. 2.
Ellis, Wm. Clyde, 115 W. Monroe St., Phoenix, Ariz. 1.
Elsey, J. R., Glenwood, Minn. 3.
English, C. H., Fort Wayne, Ind. 8, 2.
Equi, Marie D., Central Bldg., Portland, Ore. 4.
Erck, Theo. A., 251 S. 13th St., Philadelphia. 2.
Eshleman, L. H., 2923 S. Washington St., Marion, Ind. 3.
Eskridge, Belle C., 412 Temple Bldg., Houston, Tex. 4.
Estel, G. A., Jacob, Ill. 0.
Evans, C. M., Clifford, Ill. 4.
Ewer, Edward N., 176 Santa Rosa Ave., Oakland, Cal. 5, 1.

Fair, H. D., 103 Vatel Bldg., Muncie, Ind. 4.
Fair, Robt. P., 481 Beacon St., Boston. 2.
Fairbanks, C., 24 Main St., St. Johnsbury, Vt. 4.
Fairchild, F. D., 4521 Central Ave., Los Angeles, Cal. 1.
Falls, F. H., 2800 Washington Blvd., Chicago. 4.
Farrar, Lillian K. P., 40 W. 96th St., New York City. 4.
Feeley, Matilda A., 1700 Sutter St., San Francisco. 1.
Feidt, Wilson Wellington, 1028 Andrus Bldg., Minneapolis, Minn. 3.
Fifield, Emily W., 431 Syndicate Blk., Minneapolis, Minn. 3.
Findley, Palmer, 3602 Lincoln Blvd., Omaha. 1, 2.
Finley, C. S., 104 East 40th St., New York City. 2, 3.
Fisher, John M., 222 S. 15th St., Philadelphia. 6, 7, 9, 4.
Fisher, W. H., 416 Colton Bldg., Toledo, Ohio. 8, 3.
Fithian, J. W., 608 Broadway, Camden, N. J. 6, 9, 2, 4.
Fletcher, Arthur J., Homer, Ill. 3.
Floyd, J. C. M., 224 N. 5th St., Steubenville, Ohio. 3, 4.
Fortun, O. J., Mayville, N. Dak. 3.
Foster, C. S., 5745 Ellsworth St., Pittsburgh. 2, 3.
Foulkrod, Collin, 4022 Chestnut St., Philadelphia. 0, 2.
Frame, C. N., Ewing, Mo. 0.
Frank, Robt. T., Hanover, 83d St. and Park Ave., New York City. 3.
Franklin, Geo. W., Jefferson, Ia. 3.
Freeburg, H. M., Watertown, S. Dak. 8, 3.
Freeman, J. P., Glenville, Minn. 3.
Freeman, T. O., Mattoon, Ill. 0.
French, Charles E., 701 Phelan Bldg., San Francisco. 1.
Friduss, S. L., 1809 W. 47th St., Chicago. 4.
Froehlich, Herman W., % Stevenson Iron Mining Co., Crosby, Minn. 0.
Fry, H. D., 1929, 19th St. N.W., Washington, D. C. 4, 6, 7, 8, 9, 0.
Fuchs, Walter H., 3202 Lafayette Ave., St. Louis. 0.
Fuhrmann, R. H., 3221 California Ave., St. Louis. 0.
Furniss, H. D., 393 W. End Ave., New York City. 9, 2, 3, 4.
Furniss, John N., 602 Lauderdale St., Selma, Ala. 2.

Gage, G. R., 27½ N. Main St., Hutchinson, Kan. 3.
Gardner, Edwin L., 1011 E. River Rd., Minneapolis, Minn. 3.
Gardner, M. N., Greenleaf, Kan. 0.
Gardner, Paul E., New Hampton, Iowa. 3.
Gardner, Wm. S., 6 W. Preston St., Baltimore. 4, 6, 9, 0, 2, 4.
Garlick, S. M., 474 State St., Bridgeport, Conn. 2.
Garrabrant, C., 19 N. Penn Ave., Atlantic City, N. J. 6, 9, 3.
Garrison, J. Frank, Oldham, S. Dak. 3.
Garvin, D. E., 835, 12th St., Golden, Colo. 2.
Gatchell, Ella F., Chico, Cal. 1.
Gates, L. M., 802 Muckberry St., Scranton, Pa. 1, 2, 3.
Gayler, W. C., Wall Bldg., St. Louis. 0.
Gebrung, Eugene C., 3857 Westminster Pl., St. Louis. 0.
Gelder, E. E., 623 Jeff Bldg., Peoria, Ill. 2.
Gelhorn, George, 713 Metropolitan Bldg., St. Louis. 8, 0, 3.

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George, Jas. W., 412 Reid Corner, Minneapolis, Minn. 3.
Gerould, T. F., 117½ Locust St., Centralia, Ill. 3.
Gibb, W. Travis, 42 W. 75th St., New York City. 1.
Gibbons, Henry W., 3491 Pacific Ave., San Francisco. 1.
Gibbs, Roy S., 425, 4th St., San Bernardino, Cal. 1.
Gilbert, W. H., 10 Walnut St., Evansville, Ind. 0.
Gilliam, D. Todd, Columbus State Hosp., Columbus, Ohio. 7, 8, 0.
Gillmore, Robert T., 1230 E. 63d St., Chicago. 5, 7, 0.
Girvin, John H., 2121 Walnut St., Philadelphia. 4, 9, 4.
Glaser, M. J., 1825 S. Jefferson Ave., St. Louis. 0.
Glasgow, Frank A., 3894 Washington Ave., St. Louis. 0.
Gledhill, Henry R., Jerseyville, Ill. 6, 0.
Gockley, A. S., Carroll, Iowa. 2, 4.
Goffe, J. Riddle, 616 Madison Ave., New York City. 4, 5, 6, 7, 0, 2, 3, 4.
Goldspohn, A., 2118 Cleveland Ave., Chicago. 4, 5, 6, 7, 0, 1, 2, 3, 4.
Good, Wm. H., E. Wyoming Ave., Philadelphia. 4.
Grad, Herman, 159 W. 120th St., New York City. 6, 7, 9, 2, 4.
Gragg, Vincent J., Clanton, Ala., 3, 4.
Grausman, Philip M., 130 W. 58th St., New York City. 4.
Graves, Wm. P., 244 Marlborough St., Boston. 2.
Greene, Thos. F., 322 Warren St., Boston. 9, 2.
Greenfield, B. H., 205 S. Orange Ave., Newark, N. J. 2.
Greer, Bertha A., Lamoni, Iowa. 0, 1.
Grimmer, R. D., 365 Fulton Ave., Hempstead, N. Y. 4.
Gronwold, Arthur C., Fort Ransom, N. D. 3.
Guinn, J. H., 1056 E. 1st St., Long Beach, Calif. 1.
Gunderson, Harley J., 1422 W. Lake St., Minneapolis, Minn. 3.
Guthrie, J. R., 1005 Locust St., Dubuque, Iowa. 4, 5, 1, 3.

Haagensen, E. C., Hillsboro, N. D. 3.
Hablutzel, C. E., 105 11th St., San Jose, Cal. 1.
Haight, G. G., Audubon, Minn. 3.
Haley, James F., Midland, Tex. 1.
Hall, C. Lester, 523 Bryant Bldg., Kansas City, Mo. 4, 6, 0, 3.
Hall, John M., 14 Central Pk., West, New York City. 2.
Hall, R. B., Berkshire Bldg., Cincinnati. 9, 2, 3.
Hamilton, B. C., Jefferson, Ia. 3.
Hammond, Frank C., 3338 N. Broad St., Philadelphia. 7, 9, 4.
Hammond, Jas. Felton, 334 Lowry Bldg., St. Paul, Minn. 3.
Hanna, Geo. A., 4840 Frankford Ave., Philadelphia. 4.
Hanna, M. A., 638 Lathrop Bldg., Kansas City, Mo. 0.
Hannah, Calvin R., 512 S. W. Life Bldg., Dallas, Tex. 4.
Hanser, H. A., 3651 Delmar Blvd., St. Louis. 0.
Hanson, Geo. C., Charlson, N. D. 3.
Harbert, G. E., Beverly, N. J. 2, 4.
Harden, Albert S., 540 Warren St., Newark, N. J. 4.
Hargrave, E. T., 816 Redgath Ave., Norfolk, Va. 6, 0.
Harman, Wm. J., 1162 E. State St., Trenton, N. J. 2.
Harmann, M. F., 3441 N. 9th St., St. Louis. 0.
Harris, Philander A., 453 Park Ave., Paterson, N. J. 6, 7, 9, 3, 4.
Hart, Robt. S., 622 J. M. S. Bldg., South Bend, Ind. 3.
Harter, Isaac F., Stronghurst, Ill. 1.
Hartley, Harriet L., 1501 N. 17th St., Philadelphia. 4.
Hartman, John V., Findlay, O. 3.
Hartung, Henry, 722 Diversey Parkway, Chicago. 5, 6, 8, 0.
Hartwell, D. D., Marion, Ill. 3.
Hartz, Harry J., 1002 Jackson St., Philadelphia. 4.
Harvey, E. M., Media, Pa. 9, 2.
Harvey, E. H., 20 N. Florida Ave., Atlantic City, N. J. 2.
Hayd, Herman E., 493 Delaware Ave., Buffalo, N. Y. 4.
Hayden, A. M., Evansville, Ind. 3, 4.
Hayes, Nellie S., 306 Ferguson Bldg., Los Angeles, Cal. 1.
Heaney, N. Sproat, 5548 Woodlawn Ave., Chicago. 3.
Heflin, Wyatt, Birmingham, Ala. 4.
Heimark, A. J., Finley, N. D. 3.
Heineberg, Alfred, 1642 Pine St., Philadelphia. 9, 2.
Heinecke, Geo. B., 5634 Georgia Ave., N.W., Washington, D. C. 9, 2.
Heisz, Emily J., Nora Springs, Ia. 1.
Heller, Jacob, 1199 Eastern Parkway, New York City. 2, 4.
Henry, Clifford E., 715 Donaldson Bldg., Minneapolis, Minn. 3.
Henry, W. O., 610 Brandies Theater Bldg., Omaha, Neb. 2, 3.
Hensel, Chas. N., 223 Moore Bldg., St. Paul, Minn. 3.
Herington, Warner, Green City, Mo. 0.
Herrman, Max F., 3703 Old York Rd., Philadelphia. 4.
Hertzler, Arthur E., Halsted, Kan. 1, 4.
Herzog, Geo. K., 133 Geary St., San Francisco. 1.
Heseltine, V. G., Kilkenny, Minn. 3.
Higgins, C. W., 2 George St., Providence, R. I. 4, 6, 7, 9, 2.
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Hirschfield, Adolph, 1017 Washington Ave., N., Minneapolis, Minn. 3.
Hirschfield, M. S., New Jersey Bldg., Duluth, Minn. 3.
Hobbs, Alice L., 5828 E. Wash. St., Indianapolis. 8, 1.
Hoffman, C. S., Keyser, W. Va. 0, 2.
Hoffmann, Chas. von, 2669 California St., San Francisco. 1.
Holden, Frederick C., 198 Lincoln Pl., Brooklyn. 4.
Holmes, Rudolph W., 36 E. Elm St., Chicago. 4, 8, 3.
Hollister, J. C., 302 Dodsworth Bldg., Pasadena, Calif. 1.
Holt, E. E., 1209 N. Grand Ave., St. Louis. 0.
Hopkins, M. J., 3756 Lindell Blvd., St. Louis. 0.
Hornbrook, E., Cherokee, Iowa. 1.
Horsley, J. Shelton, 330 W. Grace St., Richmond, Va. 3.
Houck, Mary P., 816 Main St., La Crosse, Wis. 3.
Howard, Chas. E., Benton, Ky. 0.
Hromadka, A. B., Sawtelle, Cal. 1.
Hubert, R. I., 853 Iglehart Ave., St. Paul, Minn. 3.
Huggins, R. R., 1018 Westinghouse Bldg., Pittsburgh. 0, 2, 4.
Hull, Edw. T., 258 W. 139th St., New York City. 0.
Humiston, Wm. H., 536 Rose Bldg., Cleveland. 4.
Humphrey, W. R., Tornius Blk., Stillwater, Minn. 3.
Hunner, Guy L., 2305 St. Paul St., Baltimore. 4, 6, 7, 9, 2.
Huson, Florence, 506 Cass Ave., Detroit. 4, 6, 7, 2, 4.
Hutchins, H. T., 374 Marlborough St., Boston. 2.
Hypes, B. M., 1615 S. Grand Ave., St. Louis. 0 .

Ill, Edgar A., 202 Clinton Ave., Newark, N. J. 4.
Ill, Edw. J., 1002 Broad St., Newark, N. J. 9, 2, 4.
Ingraham, Clarence B., Jr., 1405 Glenarm St., Denver. 1.
Ireland, Milton S., 23 S. California St., Atlantic, N. J. 4.
Irwin, John R., 401 N. Tryon St., Charlotte, N. C. 1.
Isaac, J. P., Freeman, S. D. 3.

Jackson, V. B., 1330 I St. N.W., Washington, D. C. 4.
Jacobson, Henry, 705 Olive St., St. Louis. 0.
Jacobson, J. H., 239 Michigan St., Toledo. 0, 1, 2, 3, 4.
Jermain, Hubert F., 983 12th St., Milwaukee, Wis. 3.
Jewell, Robt. T., 538 Con. Realty Bldg., Los Angeles, Cal. 1.
John, J. W., 204½ Main St., Pine Bluff, Ark. 2.
Johnson, Henriette A., White Salmon, Wash. 3.
Johnson, H. L. E., 1821 Jefferson Pl., N.W., Washington, D. C. 4, 5, 7, 9, 0, 1, 2, 3, 4.
Johnson, Ray H., 449 Franklin St., Buffalo, N. Y. 7, 2.
Johnson, W. S., 304 Story Bldg., Los Angeles, Cal. 8, 1.
Johnston, J. A., 19 W. 7th St., Cincinnati. 5, 6, 0, 1, 4.
Joistad, Arthur H., Fairdale, N. D. 3.
Jolley, Louis B., North Chicago, Ill. 3.
Jones, Thos. E., 145 Susquehanna Ave., Philadelphia. 2, 4.
Jones, Walter C., 15 E. Washington St., Chicago. 4.
Jungblut, H. C., Tripoli, Ia. 3.

Kahn, Maurice, 4627 S. Ashland Ave., Chicago. 8, 0.
Kahn, Sol. G., 821 Boston Bldg., Salt Lake City, Utah. 2.
Kasten, W. C., Fort Madison, Iowa. 0.
Keehn, G. A., 2702 N. Grand Ave., St. Louis. 0.
Keene, F. E., 116 S. 19th St., Philadelphia. 2, 4.
Keller, Frank J., Sherman and Totowa Ave., Paterson, N. J., 9, 4.
Keller, Jacob A., 771 E. 165th St., New York City. 4.
Kellogg, Chas. E., Shenandoah, Ia. 4.
Kellogg, W. C., 203 Seymour St., Syracuse, N. Y. 2.
Kelly, Howard A., 1418 Eutaw Pl., Baltimore. 4, 6, 9, 4.
Kelly, J. W., 403½ S. 6th St., Springfield, Ill. 0.
Kennedy, Bernays, Hume-Mansur Bldg., Indianapolis. 0, 3, 4.
Kennedy, Jane F., 713 Donaldson Bldg., Minneapolis, Minn. 3.
Kennedy, J. W., 1409 Spruce St., Philadelphia. 2.
Kenton, J. R., Raymond, Ill. 0.
Kepler, C. O., 362 Commonwealth Ave., Boston. 0.
Kerch, H. E., Dundee, Ill. 2.
Kerr, Wm. Randolph, Iowa. 0.
Kerwin, W., 4900 Laclede Ave., St. Louis. 0.
Kibbe, O. E., Canton, Minn. 3.
Kier, W. F., 3609 Lindell Blvd., St. Louis. 0.
Kimball, A. C., 2700 N. Grand Ave., St. Louis. 0.
King, Jas. E., 1248 Main St., Buffalo, N. Y. 4.
Kirkwood, R. C., Valmora Sanit., Watrous, N. M. 3.
Kirton, J. R. W., Oseola, Mich. 0.
Kjaerbge, C. B., Forsyth Bldg., Fresno, Cal. 1.
Klingler, M. E., Garrett, Ind. 4.
Kloman, E. H., 1819 N. Charles St., Baltimore. 4.
Klump, Geo. B., Williamsport, Pa. 4.
Knipe, N. L., 701 S. 52d St., Philadelphia. 2, 4.
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Krusen, Wilmer, 127 N. 20th St., Philadelphia. 4, 9, 2, 4.
Kurtz, Carl, 1129 S. Alvaro St., Los Angeles, Cal. 1.

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Lamb, I. H., 2114 18th St., Washington, D. C. 2.
Lambach, Fred'k, 45 Whittaker Bldg., Davenport, Iowa. 4.
Lancaster, Blake McK., Crosby, N. D. 3.
Lane, Fred W., 630½ Wheeling Ave., Cambridge, Ohio. 4.
Langworthy, S. B., Ryan Bldg., Leavenworth, Kan. 8, 3.
Larrabee, F. W., Warren, Me. 1.
Larsen, L. A., Colfax, Wis. 3.
La Vake, Rae T., 413 Pillsbury Bldg., Minneapolis, Minn. 3.
Lawrence, F. F., 328 E. State St., Columbus, Ohio. 4, 5, 6, 7, 0.
Laws, Carl H., 530 Syndicate Blk., Minneapolis, Minn. 3.
Lawson, H. W., 1117 Vermont Ave., Washington, D. C. 2.
Lazard, Edmond M., 332 S. Kingsley Drive, Los Angeles. 1.
Leavitt, Frederick E., Lowry Arcade, St. Paul, Minn. 3.
LeClerc, J. E., Le Sueur, Minn. 8, 3.
Leof, M. V., 1700 N. Franklin St., Philadelphia. 9, 2.
Leonard, Homer O., 1115 Grand St., Kansas City, Mo. 0.
Le Rosingal, W. J., Rifle, Colo. 3.
Leslie, James F., Mounds, Ill. 0.
Lewis, G. C., Fairbury, Ill. 3, 4.
Lewis, Henry F., 4426 Lake Park Ave., Chicago. 4.
Lewis, W. E., Seaside, Ore. 5, 1.
Lewis, Will J., 310 California St., Ventura, Cal. 1.
Lindley, Walter, 1414 S. Hope St., Los Angeles, Cal. 5, 1.
Lindsay, Kate, Sanitarium, Boulder, Colo. 3.
Linklater, Eugene R., 930 W. Ferry St., Buffalo, N. Y. 3.
Litzenberg, J. C., 3137 Park Ave., Minneapolis. 6, 8, 2, 3.
Lockrey, Sarah H., 1520 Vine St., Philadelphia. 4, 8, 9, 2.
Long, John Wesley, 115 Church St., Greensboro, N. C. 4.
Long, Judson H. E., 806 3d Ave., Moline, Ill. 0.
Long, Wm. H., 4657 Lancaster Ave., Philadelphia. 4.
Longaker, Daniel, 344 N. 5th St., Philadelphia. 4.
Longenecker, C. B., 3416 Baring St., Philadelphia. 4, 6, 9, 2, 4.
Loomis, E. E., Janesville, Wis. 6, 1.
Looney, Robt. N., Prescott, Ariz. 1.
Loranger, Philip J., 383 Canton Ave., Detroit, Mich. 3.
Losee, J. R., 307, 2d Ave., New York City. 4.
Lothrop, Earl P., 153 Delaware Ave., Buffalo, N. Y. 9, 0.
Luburg, L. F., 1822 Girard Ave., Philadelphia. 9, 2, 4.
Luther, F. M., 610 W. 113th St., New York City. 2.
Lyons, J. A., 6848 Anthony Ave., Chicago. 8, 3.

MacCarroll, D. R., 2503 S. Broad St., Philadelphia. 2, 4.
MacDonald, Daniel A., 1211 E. Franklin Ave., Minneapolis, Minn. 3.
MacEvitt, John C., 407 Clinton St., Brooklyn. 1, 2, 3.
MacKellar, Jas., 71 N. Church St., Hazleton, Pa. 4.
MacKenzie, John R., Carington, N. D. 3.
McAlexander, R. O., 320 N. Meridian St., Indianapolis. 6, 7, 0.
McAllister, Anna M., 3503 Baring St., Philadelphia. 4.
McCabe, W. M., City Hosp., Nashville, Tenn. 3.
McCallin, A. E., Wisconsin Veterans' Home, Wis. 0.
McCannel, A. J., Minot, N. D. 3.
McCarrol, H. R., Walnut Ridge, Ark. 0.
McCarty, T. L., Dodge City, Kan. 3.
McCay, Robt. Burns, 228 Chestnut St., Sunbury, Pa. 4.
McCoy, John H., Beattie, Kan. 3.
McCracken, R. W., Union Grove, Wis. 8, 3.
McCullough, A. H., 78 W. Park Ave., Mansfield, O. 3.
McCullough, G. T., Higgins Block, Missoula, Mont. 5, 0.
McCune, M. Virginia, Martinsburg, W. Va. 4, 0.
McDougald, John Q., 1336 Lombard St., Philadelphia. 2, 4.
McEwen, Mary G., 1703 Chicago Ave., Evanston, Ill. 0, 3.
McGann, Peter J., Augusta, Mo. 0.
McGlinn, John A., 113 S. 20th St., Philadelphia. 9, 2.
McGroarty, John J., Easton, Minn. 3.
McGuire, M. F., 44 E. State St., Montpelier, Vt. 0.
McKee, E. S., 639 W. 7th Ave., Cincinnati. 5, 6, 7, 8, 0.
McKenney, D. C., 1250 Main St., Buffalo, N. Y. 9, 3.
McLaren, J. L., Title Insurance Bldg., Los Angeles, Cal. 4.
McLean, Mary H., 4339 Delmar Blvd., St. Louis. 0.
McMahon, J. P., 406 Cudahy Apts., Milwaukee, Wis. 3.
McMullen, B. H., 210 Cass St., Cadillac, Mich. 4.
McMurray, R. J., 13th and Main Sts., Francisville, Ill. 0.
McMurtry, L. S., 5 Ormsby Pl., Louisville, Ky. 4, 5, 6, 7, 8, 0, 2, 3, 4.
McNamara, Sylvester J., 369 Union St., Brooklyn. 4.

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McNutt, Julia G., R.F.D., W. Albany, N. Y. 0.
McNutt, Sarah J., 265 Lexington Ave., New York City. 9, 0, 2.
McPherson, Ross, 20 W. 50th St., New York City. 8, 9, 0, 2, 3.
McReynolds, R. P., B. F. Coulter Bldg., Los Angeles, Cal. 4.
McSweeney, P. E., 46 N. Champlain St., Burlington, Vt. 4.
Magee, Chester L., El Monte, Cal. 1.
Magee, M. D'Arcy, 1623 Connecticut Ave., Washington, D. C. 3.
Magee, W. G., Granite Blk., Watertown, S. D. 3.
Magill, Wm. H., 221 Thayer St., Providence, R. I. 2.
Maier, F. Hurst, 1900 Chestnut St., Philadelphia. 4.
Maison, Robert S., Chester, Pa. 2.
Mallett, G. H., 244 W. 73d St., New York City. 9, 2.
Mann, Bernard, 107 N. 60th St., Philadelphia. 4.
Manton, W. P., 32 W. Adams Ave., Detroit. 4, 5, 6, 7, 8, 9, 0, 2.
March, E. J., 322 S. Cleveland Ave., Canton, Ohio. 4, 9, 0, 1, 2, 3, 4.
Marcy, Henry O., 180 Commonwealth Ave., Boston. 4, 6, 7, 8, 9, 0, 2, 3, 4.
Marken, Martin H., Boyd, Minn. 3.
Markoe, Jas. W., 20 W. 50th St., New York City. 2, 3.
Marshall, Clara, Buck Hill Falls, Pa. 0, 1.
Martin, F. H., 30 N. Michigan Ave., Chicago. 6, 1, 3.
Marx, Ella, 4161 Washington Ave., St. Louis. 0.
Massey, G. Betton, Sanit., 1823 Wallace St., Philadelphia. 4, 6, 7, 9, 0, 2, 4.
Mathews, Wm. J., 1009 Garden St., Hoboken, N. J. 9, 2, 4.
Maurer, Edmund L., Brownton, Minn. 3.
Maury, John M., Memphis Trust Bldg., Memphis, Tenn. 4.
Max, C. O. C., 1889 Ry. Exchg. Bldg., St. Louis. 0.
May, Wayne H., 400 Central Ave., Minneapolis, Minn. 3.
Mayes, J. A., 324½ N. Main St., Denison, Tex. 0.
Mayland, M. L., 225½ Central Ave., Faribault, Minn. 8, 3.
Mayne, Wm. H., 917 Brockman Bldg., Los Angeles, Cal. 1.
Meanes, L. L., 302 Securities Bldg., Des Moines, Iowa. 2.
Meek, Edward, 226 Masonic Temple, Little Rock, Ark. 0.
Megrail, W. P., Penn and Zane Sts., Wheeling, W. Va. 4.
Meierding, Wm. A., Springfield, Minn. 3.
Mellby, O. F., Thief River Falls, Minn. 3.
Melvin, J. Tracy, Porterville, Cal. 1.
Mendenhall, T. E., Beaverdale, Pa. 4.
Mensel, Harry H., 65 Main St., Oshkosh, Wis. 3.
Messinger, M. P., Oakfield, N. Y. 3.
Meyers, Elmer L., 17 W. South St., Wilkes-Barre, Pa. 2.
Michaux, Stuart, 962 West Franklin St., Richmond, Va. 2.
Miller, C. Jeff, 1638 Joseph St., New Orleans. 6, 7, 8, 9, 0, 1, 2, 4.
Miller, Harold A., 617 Pittsburgh Life Bldg., Pittsburgh, Pa. 9, 2, 4.
Miller, John D., Norfolk Bldg., Cincinnati. 4.
Miller, Mary T., 313 N. 33d St., Philadelphia. 2, 4.
Miller, S. M., Box 544, Knoxville, Tenn. 9, 1, 4.
Miller, Theo., 1110 Euclid Ave., Cleveland. 4.
Miller, V. A., Lake Arthur, La. 8, 3.
Miller, W. E., Columbus, Ill. 8, 1.
Mills, Henry M., 192A 6th Ave., Brooklyn. 6, 7, 9, 2.
Miner, Elizabeth R., Macomb, Ill. 0.
Missimore, L. E., 4869 Page Ave., St. Louis. 0.
Mitchell, John H., 305 N. 16th St., Mt. Vernon, Ill. 0, 4.
Mitchell, Ralph S., Grand Meadow, Minn. 3.
Mitchell, Robert L., 2112 Maryland Ave., Baltimore. 9, 4.
Mock, Harry E., 3532 W. Adams St., Chicago. 3.
Molz, Chas., Murphysboro, Ill. 4.
Montgomery, E. B., Box 128, Quincy, Ill. 8, 0.
Montgomery, E. E., 1426 Spruce St., Philadelphia. 4, 5, 6, 7, 8, 9, 0, 1, 2, 3, 4.
Montgomery, F. H., 478 W. Broadway, Danville, Ky. 3.
Moore, James S., Medical Bldg., Portland, Ore. 1.
Moore, M. L., 340 S. Kinsley Drive, Los Angeles, Cal. 1.
Moore, Will H., Kerr Robert, Sask., Canada. 3.
Moran, John F., 2420 Penn. Ave., Washington, D. C. 4.
Morehouse, G. G., Hotel Owatonna, Owatonna, Minn. 3.
Morris, E. J., 488 9th St., Brooklyn. 2, 4.
Morris, L. C., 1203 Empire Bldg., Birmingham, Ala. 2, 4.
Morris, Margaret M., 608 Hollingsworth Bldg., Los Angeles, Cal. 1.
Morrison, John B., 97 Halsey St., Newark, N. J. 4.
Morrison, N. D., 3d St., San Mateo, Cal. 1.
Mortensen, Wm. S., Palms, Cal. 1.
Morton, Ada S. C., 901 Butler Bldg., San Francisco, Cal. 3.
Morton, Rosalie S., Hotel Lenori, 63d and Madison Ave., New York City. 4.
Mosher, Clelia D., 1094 Emerson St., Palo Alto, Cal. 4.
Mosher, Eliza M., 184 Joralemon St., Brooklyn. 9, 0.
Mount, Walter B., 21 Plymouth St., Montclair, N. J. 4.
Munter, Leo, 515 Hewes Bldg., San Francisco. 1.

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Murdoch, H. G., Taylor's Falls, Minn. 3.
Murphy, J. C., 4916 McPherson Ave., St. Louis. 0.
Murphy, Wm. B., 2652 Bloomington Ave., Minneapolis, Minn. 3.
Murray, Grace P., 50 W. 45th St., New York City. 2.
Murray, Janet, 14 Mynderse St., Schenectady, N. Y. 1.
Muse, B. P., 1039 Edmondson Ave., Baltimore. 4.
Myers, J. F., 333½ W. State St., Jacksonville, Ill. 0.

Naegeli, Frank, Manhattan Bldg., Fergus Falls, Minn. 3.
Nash, A. B., 10 S. 13th St., Newark, N. J. 2.
Neff, G. R., Farmington, Iowa. 0, 1.
Newman, Henry P., 1560 8th St., San Diego, Cal. 4, 6, 0, 1, 2.
Newman, J. W., 3516 Prytania St., New Orleans. 0.
Newton, John C., 291 Geary St., San Francisco. 1.
Nieder, Chas. F., 140 Genesee St., Geneva, N. Y. 4.
Nielson, A. F. O., Oakley, Idaho. 3.
Nihiser, Winton M., 128 E. Antietam St., Hagerstown, Md. 4.
Noble, Thos. B., 720 Newton Claypool Bldg., Indianapolis. 2.
Noordewier, A., 821 E. Wealthy St., Grand Rapids, Mich. 4.
Norris, R. C., 500 N. 20th St., Philadelphia. 4, 9, 2.
Novak, Emil, 839 Patterson Park Ave., Baltimore, Md. 9, 0, 2, 4.
Nye, H. W., Osborne, Kan. 3.

Ogden, B. H., 546 Holly Ave., St. Paul, Minn. 3.
Oliver, A. H., 121 Vandalia St., Edwardsville, Ill. 0.
Olsen, S. H., Milaca, Minn. 0.
Oppegaard, M. O., New London, Minn. 3.
Osborn, Geo. R., 805 Jefferson Ave., La Porte, Ind. 2, 4.
Outerbridge, Geo. W., 2040 Chestnut St., Philadelphia. 4.
Overton, John, Douglas Infirmary, Nashville, Tenn. 3.
Oyler, H. S., Lincoln, Ill. 0.

Page, Addison C., 210 Equitable Bldg., Des Moines, Ia. 3.
Palmer, Sarah E., 483 Beacon St., Boston. 4.
Pampel, B. L., Livingston, Mont. 3.
Pancoast, Henry K., Box 203, Philadelphia. 4.
Pantzer, H. O., 717 Woodruff Pl., Indianapolis. 4, 5, 6, 7, 8, 9, 0, 2, 4.
Park, Frederick S., 4106 Girard Ave., Philadelphia. 4.
Parker, L. Maud, Lumber Exchange, Seattle, Wash. 4.
Parke, Wm. E., 1739 N. 17th St., Philadelphia. 4, 9, 2.
Parmenter, Geo. H., 106 E. State St., Montpelier, Vt. 3.
Parrish, Geo., 216 Medical Bldg., Portland, Ore. 0.
Parry, Angenette, 749 Madison Ave., New York City. 2.
Parsonnet, Victor, 124 W. Kinney St., Newark, N. J. 2.
Parsonnet, Victor, 124 W. Kinney St., Newark, N. J. 4.
Paschall, J. B., Fulton, Ky. 0.
Patterson, Robt. U., U. S. Army, Washington, D. C. 2, 4.
Patton, Chas. L., 628 E. Capitol St., Springfield, Ill. 0, 3.
Peck, Geo. A., 87 Center Ave., New Rochelle, N. Y. 0.
Pederson, Reuben M., 1010 Donaldson Bldg., Minneapolis, Minn. 3.
Pedigo, S. E. G., New Marshfield, Ohio. 0.
Pennington, J. R., 31 N. State St., Chicago. 3, 4.
Perry, Samuel W., 164 Leasure Ave., New Castle, Pa. 1.
Peters, Lulu H., 2219 W. 9th St., Chicago. 1.
Peterson, Geo. E., 343 Broadway, Waukesha, Wis. 3.
Peterson, Reuben, Ann Arbor, Mich. 6, 7, 9, 0.
Pfaff, O. G., 338 Newton Claypool Bldg., Indianapolis. 6, 7, 2, 4.
Pfahler, Geo. E., 1321 Spruce St., Philadelphia. 4.
Pinkham, Edwin W., 267 W. 89th St., New York City. 4.
Piper, Edmund B., 6071 Drexel Rd., Philadelphia. 4.
Polak, John O., 287 Clinton Ave., Brooklyn. 4, 6, 7, 9, 1, 2, 3, 4.
Polk, W. M., 7 E. 36th St., New York. 3.
Pollock, A. R., Monte Vista, Colo. 3.
Potter, I. W., 420 Franklin St., Buffalo, N. Y. 9, 0, 2.
Potter, Marion Craig, 1487 South Ave., Rochester, N. Y. 9, 2.
Potts, F. T., Toluca, Ill. 0.
Powell, Ignatius W., Grand and Easton Ave., St. Louis. 0.
Purnell, Caroline M., 132 S. 18th St., Philadelphia. 4, 9, 2, 4.
Pyle, J. L., Chester, W. Va. 4.

Raab, Ernest P., 301 S. High St., Belleville, Ill. 7, 0.
Randall, Lillian C., 221 Sherman Ave., New York City. 4.
Rankin, W. H., 151 Hancock St., Brooklyn, N. Y. 3.
Ratajski, J. E., 16 E. 2d St., Mt. Carmel, Pa. 2, 4.
Raymer, H. S., Cedar Rapids, Ia. 3.
Reddick, J. T., Paducah, Ky. 6, 7, 1.
Reed, Charles A. L., 3544 Biddle St., Cincinnati. 6, 9, 2, 4.
Reese, Frank D., 16 Tompkins St., Cortland, N. Y. 4.
Reilly, John P., 215 Elizabeth Ave., Elizabeth, N. J. 2, 4.
Reynolds, Chas. B., 2003 Diamond St., Philadelphia. 9, 2, 4.
Reynolds, E., 321 Dartmouth St., Boston, Mass. 6, 7, 3.
Reynolds, H. R., Clinton, Ia. 3.
Rhodes, F. A., 632 Herron Ave., Pittsburgh. 2.
Rice, Dell Frank, 5641 Von Versen Ave., St. Louis. 0.

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Rice, E. E., Shawnee, Okla. 8, 1.
Richards, Raymond G., St. David, Ill. 3.
Richardson, Anna G., 483 Beacon St., Boston. 4.
Richardson, Emma M., 581 Stevens St., Camden, N. J. 4, 9, 2, 4.
Richmond, W. W., Clinton, Ky. 5, 1.
Ries, Emil, 30 N. Michigan Ave., Chicago. 0, 3.
Riley, Percy E., Elk Mound, Wis. 3.
Risk, Winthrop A., State Home and School, Providence, R. I. 9, 2.
Ritter, Caleb A., 702 Bryant Bldg., Kansas City, Mo. 0, 2.
Roan, Carl M., 401 Cedar Ave., Minneapolis, Minn. 3.
Robb, Hunter, Rose Bldg., Cleveland, Ohio. 8, 2.
Robbie, Mary King, Hicks Bldg., San Antonio, Texas. 0.
Roberts, W. B., 604 Pillsbury Bldg., Minneapolis, Minn. 3, 4.
Robertson, John B., Cottonwood, Minn. 3.
Robson, John A., Hall, N. Y. 4.
Rodgers, Chas. L., 700 W. Lake St., Minneapolis, Minn. 3.
Rodman, W. W., Pierce City, Mo. 0.
Rogers, Joseph D., 1400 M St., Washington, D. C. 2, 4.
Rogers, Thos. L., 405 L. B. Bank Bldg., Long Beach, Cal. 1.
Rogier, Henry O., Mason City, Ill. 0.
Rongy, A. J., 154 Henry St., New York City. 2, 4.
Rosengren, Chas. J., 218 E. Ferry St., Buffalo, N. Y. 2, 3, 4.
Rosenthal, Max, 26 W. 90th St., New York City. 9, 0.
Rothenburg, Samuel, 22 W. 7th St., Cincinnati. 1.
Rothrock, J. L., 235 Lowry Arcade, St. Paul, Minn. 6, 7, 0, 3.
Rotter, Chas. F., 1910 Arsenal St., St. Louis, Mo. 0.
Rowe, Wm. H., St. James, Minn. 3.
Rubinow, S. M., 602 High St., Newark, N. J. 2.
Rudasill, J. E., Marshall, Va. 2.
Rumford, S. C., 1403 Market St., Wilmington, Del. 2.
Rushmore, Stephen, 520 Beacon St., Boston. 2, 4.
Rusk, Elizabeth, 4215 Delmar Blvd., St. Louis. 0.
Russell, Rose A., State Hospital, Cherokee, Iowa. 0.
Russell, Thos. H., Jr., 411 Temple St., New Haven, Conn. 4.
Russell, Wm. W., 1208 Eutaw Pl., Baltimore. 4, 9, 4.
Ryland, C. T., 1022 Main St., Lexington, Mo. 0.

Sadler, Lena K., 32 N. State St., Chicago. 8, 1.
Sahlender, Otto L., 321 W. Grand Ave, St. Louis. 0.
Sanes, K. I., 519 Jenkins Bldg., Pittsburgh. 4, 6, 7, 9, 0, 2, 3, 4.
Sampson, John A., 180 Washington St., Albany, N. Y. 4, 6, 0.
Saunders, Orris W., 1700 Broadway, Camden, N. J. 4.
Sawyer, Chas. J., Windsor, N. C. 9, 2.
Sawyer, M. H., 401 Central Life Bldg., Ottawa, Ill. 3.
Seashore, D. E., 403 Central Ave., Duluth, Minn. 3.
Shann, Herman, 207 Hart St., Brooklyn. 2.
Scheel, A. M., Belleville, Ill. 0.
Schenck, B. R., 32 Adams Ave., W., Detroit. 8, 9, 2.
Schlossstein, A. G., 3153 Longfellow Blvd., St. Louis. 0.
Schmeling, A. F., Columbus, Wis. 9, 0, 3.
Schmitz, Henry, 1618 W. Chicago Ave., Chicago. 4.
Schoenberg, Albert J., 2432 Lincoln Ave., Chicago. 0.
Scholl, Albert J., 1336 S. Main St., Los Angeles, Cal. 1.
Schulz, Edward, 1725 S. 7th St., St. Louis. 0.
Schumann, Edward A., 15 Pelham Rd., Philadelphia. 2, 6, 9, 4.
Schwarz, Henry, 440 N. Newstead Ave., St. Louis. 9, 0, 2, 3, 4.
Schwarz, Otto Henry, 440 N. Newstead Ave., St. Louis. 4.
Scull, Wm. B., 3024 Richmond St., Philadelphia. 9, 1, 2, 3.
Seippel, Clara P., 2300 Michigan Ave., Chicago. 3.
Seymour, F. E., Fort Dodge, Ia. 3.
Sexton, J. C., Rushville, Ind. 1.
Shafer, H. O., 1200 N. Dearborn St., Chicago. 0, 3.
Shafer, Winfield S., Rochester, Ind. 0.
Sherrick, C., Monmouth, Ill. 3.
Sherwood, H. H., Humboldt, S. D. 3.
Shimer, Sterling D., 120 N. 3d St., Easton, Pa. 9, 2, 4.
Shlenker, Milton A., 3804 St. Charles Ave., New Orleans. 0.
Shoemaker, G. E., Eagles Mere, Pa. 4, 6, 7, 9, 0, 2, 4.
Short, R. B., Union Mills, Ind. 0.
Shrom, Ralph E., 1745 N. 17th St., Philadelphia. 4.
Shulean, N. S., Cambridge, Minn. 3.
Sica, Samuel, Trenton, N. J. 4.
Sigmond, Harvey W., Ben Hur Bldg., Crawfordsville, Ind. 0.
Simpson, Abbie Winegar, 10th and Linden St., Long Beach, Cal. 1.
Simpson, F. F., 7th floor Jenkins Arcade Bldg., Pittsburgh. 4. 6, 7, 9, 0, 1, 2, 3, 4.
Singer, Jacob Jesse, 606 Carleton Bldg., St. Louis. 0.
Sivertsen, Ivar, 3404 10th Ave., S., Minneapolis, Minn. 3.
Skeel, Donald W., 1236 Merchants Nat. Bk. Bldg., Los Angeles, Cal. 1.
Skinner, John O., 31st and Cherry Sts., Kansas City, Mo. 3.
Slocumb, Maude S., 3535 Fremont Ave., N., Minneapolis, Minn. 8, 3.
Small, W. B., 2232 Green St., Philadelphia. 9, 4.
Smith, A. J., 622 Osage St., Leavenworth, Kan. 3, 4.

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Smith, D. Edmund, 404-6 Reid Corner, Minneapolis, Minn. 3.
Smith, Frederick Le Roy, Eyota, Minn. 0.
Smith, H. W., Roodhouse, Ill. 0.
Smith, J. C., 145 Brackenridge Ave., Tarentum, Pa. 2.
Smith, Jos. J., 325, 13th Ave., Newark, N. J. 4.
Smith, J. L., Williston, S. C. 4.
Smith, L. S., Monough, W. Va. 0.
Smith, L. W., 6024 Station St., E. E., Pittsburgh. 4.
Smith, Mary A., 33 Newberry St., Boston. 3.
Smith, Norman M., 3010 Hennepin Ave., Minneapolis, Minn. 3.
Smith, P. Albert, 213 Main St., Faribault, Minn. 3.
Smith, Richard R., Metz Bldg., Grand Rapids, Mich. 9, 0, 1, 2, 3.
Somers, George B., 2662 Vallejo St., San Francisco. 5, 1, 2, 3.
Southmayd, Le Roy, 7-8 Tod Blk., Great Falls, Mont. 4.
Spaeth, Wm. L. C., 5000 Jackson St., Philadelphia. 4.
Spain, Kate C., 5706a Etzel Ave., St. Louis. 0.
Spalding, Alfred Baker, Lane Hosp., San Francisco. 3.
Spears, Claude G., Live Oak, Altus, Okla. 3.
Spiller, Wm. H., 307 Second Ave., New York City. 9, 1, 2.
Sprecher, S., Tripp, S. D. 3, 4.
Sprigg, W. M., The Rochambeau, Washington, D. C. 4, 8, 2.
Springer, Willard, 810 Washington St., Wilmington, Del. 2.
Spurlock, G. H., 3217 Austin St., Houston, Tex. 3.
Spurney, A. B., Reserve Trust Bank Bldg., Cleveland. 2, 3, 4.
Spurney, A. F., 403 Osborn Bldg., Cleveland, Ohio. 9, 2, 3, 4.
Stahl, Alfred, 550 Bergen St., Newark, N. J. 9, 2.
Stamm, Camille J., 1412 Diamond St., Philadelphia. 4.
Staples, A. H., 1739 S. St., N.W., Washington, D. C. 2, 4.
Stark, Bertha Wagner, 1065 Sutter St., San Francisco. 1.
Stark, Sigmar, 11½ E. 8th St., Cincinnati. 4.
Stein, Arthur, 11 E. 68th St., New York City. 9, 2.
Stelle, H. L., 502½ Broadway, Pittsburg, Kan. 1.
Stillians, Daniel C., 414 W. Colton Ave., Redlands, Cal. 1.
Stillwagen, Chas. A., Bellefield Dwelling, Pittsburgh. 2.
Stimson, Cheney M., 1801 Cayuga St., Philadelphia. 4.
Stoeltzing, C. A., 759 E. 105th St., Cleveland. 2, 3.
Stone, I. S., Stoneleigh Ct., Washington, D. C. 4, 6, 7, 8, 9, 4.
Storrs, Henry John, 4518 Washington Ave., St. Louis. 0.
Strange, J. W., Loogootee, Ind. 0.
Strasser, August A., Arlington, N. J. 7, 9, 4.
Stubbs, H. J., 1204 Delaware Ave., Wilmington, Del. 2, 4.
Stuckert, Harry, 2116 N. 21st St., Philadelphia. 4.
Sturmdorf, Arnold, 51 W. 74th St., New York City. 2.
Sullivan, W. G., 319 Prairie Ave., Providence, R. I. 6, 8, 0, 4.
Sundin, P. O., 1516 Girard St., Los Angeles, Cal. 3.
Sutton, Frederic A., 112 Day St., Orange, N. J. 4.
Sutton, F. M., 1101 Empire Life Bldg., Atlanta, Ga. 4.
Sutton, H. T., 37 S. 6th St., Zanesville, Ohio. 0, 3.
Swahlen, P. H., St. Ann's Asylum, St. Louis. 8, 9, 0, 1.
Swift, John B., Jr., 421 Marlboro St., Boston. 2.

Taneyhill, G. Lane, 1103 Madison Ave., Baltimore. 9, 2, 4.
Taussig, Fred J., 4506 Maryland Ave., St. Louis. 5, 6, 8, 0, 2, 3.
Taylor, H. C., 32 W. 50th St., New York City. 2.
Taylor, Wm. W., Randolph Bldg., Memphis, Tenn. 4.
Tebbetts, Hiram B., 408 Bradbury Bldg., Los Angeles, Cal. 1.
Teel, A. W., L. Box 74, Glendale, Cal. 1.
Telford, A. T., 124 S. Fair St., Olney, Ill. 2.
Thienhaus, C. O., 883 Cambridge Ave., Milwaukee. 8, 2, 3.
Thomas, Geo. E., 1 E. Lake St., Minneapolis, Minn. 3.
Thomas, H. H., Decorah, Ia. 3.
Thome, W. M., Mount Joy, Pa. 4.
Thompson, A. S., Mt. Horeb, Wis. 3.
Thompson, Harry F., Forest City, Ia. 3.
Thompson, Logan M., Macon, Mo. 0.
Thompson, Wm. M., 512 Wrightwood Ave., Chicago. 4.
Thornby, H. J., Barnesville, Minn. 3.
Thorpe, John N., 5100 S. Marshfield Ave., Chicago. 3, 4.
Throckmorton, Jeannette F., Charlton, Ia. 3, 4.
Todd, Frank L., 804 Sherman Ave., Pittsburgh. 4.
Tompkins, Christopher, 116 E. Franklin St., Richmond, Va. 5, 6, 1.
Toombs, Percy W., 1108 Exchange Bldg., Memphis, Tenn. 0.
Townsend, Mary E., 13 S. Pennsylvania Ave., Atlantic City, N. J. 9, 2, 4.
Towslee, L. G., 8118 Carnegie Ave., Cleveland. 2.
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